E W Baker

The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

JUNE 1937

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The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

JUNE 1937

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1913 — 1937

We are pleased to dedicate this issue of the REVIEW to the Officers and Members of the American Electro-Platers' Society. We wish you all a most enjoyable time in celebrating Our Silver Jubilee.

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The MONTHLY REVIEW

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Publication and Editorial Office
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Springfield, Massachusetts

VOL. XXIV JUNE 1937 NO. 6

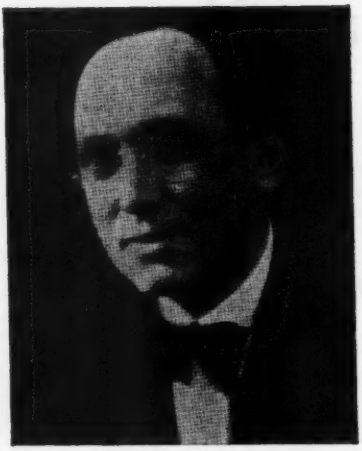
Editorial

Beginning Monday morning June 14, and continuing until Thursday the 17th, the Silver Jubilee of the American Electro-Platers' Society will be celebrated. Everything points to a most successful series of meetings, with plenty of entertainment and sociability to help make the event more interesting.

The educational sessions this year should prove to the most sceptical that our active members are still willing to exert themselves in presenting practical papers. These men deserve great commendation for the time and effort necessary to the preparation of the subjects to be presented and should receive every encouragement with as little embarassment as possible from those who are inclined to be too technically minded during the discussions.

There will be papers from technical men too, and to these members and friends of the A. E. S. should be given our hearty thanks for their splendid contributions during the past years, not only for the papers they present at the Convention and Branch meetings, but for their earnest endeavor in many other lines, which in no small degree is responsible for the growth and progress of the organization.

With a deep sense of appreciation we take this opportunity of expressing to President E. Steen Thompson our thanks for his sound judgment and earnest cooperation with all branches of the work during the year. He and his associates on the Executive Board, Messrs. Slattery, Eichstaedt, and Hanlon are to be congratulated for the work they have done in increased membership, finances, and interest.



E. STEEN THOMPSON

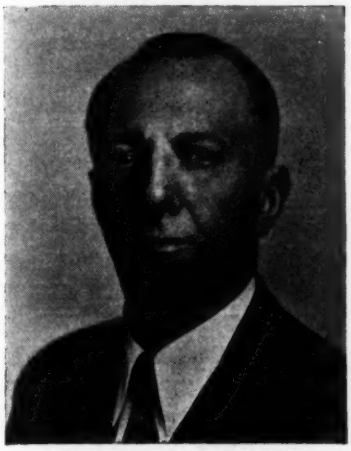
He was President of Cleveland Branch 1930-1933; First Vice-President A.E.S. 1932-1934; Secretary-Treasurer A.E.S. 1934-1936; President 1936-1937.

The Research Committee consists of:

W. M. Phillips	General Motors Corp.
E. A. Anderson	New Jersey Zinc Co.
William Blum	Bureau of Standards
G. M. Cole	Delco Remy Co.
G. B. Hogaboom	Hanson-Van Winkle-Munning Co.
Carl Huessner	Chrysler Corp.
B. H. McGar	Chase Brass & Copper Co.
Walter R. Meyer	General Electric Co.
P. M. Savage	McGeon Chem. Co.
Jos. Sexton	Sargeant & Co.
Erwin Sohn	Standard Sanitary Co.
Claude S. Tompkins	J. B. Ford Sales Co.
W. A. Wesley	International Nickel Co.
E. Steen Thompson	President of the A. E. S.
W. J. R. Kennedy	Executive Secretary

These men have done a fine job, the details of which will be explained at the opening educational session by Messers. Phillips, Strausser, and Dr. Blum. Under Mr. Phillips' direction, the finances for continuation of Research work at the Bureau are assured for the coming year.

The New York Convention Committee, with Mr. Franklyn J. MacStoker as Chairman, according to all indications, has prepared a fine program. The committees both men and women, having the work in charge should receive hearty congratulations



FRANKLYN J. MACSTOKER
General Chairman New York Convention Committee

Native New Yorker; born in Brooklyn, N. Y., November 1st, 1889. Attended elementary and high school in Greater New York and later completed several evening courses in chemistry and applied electro chemistry at Brooklyn Evening Technical School and at Cooper Union, New York City, and Buffalo School of Science.

Started his career in the plating and allied industries in 1905 with the old firm of E. G. Webster & Son, silver ware manufacturers, Brooklyn, N. Y. Remained there for period of his apprenticeship, followed by several years of employment with such concerns as the K. & O. Company, manufacturers of metal novelties, Royal Typewriter Company of Brooklyn and Hartford, Ct., Meriden Brittania Company, Meriden, Conn., returning to New York to take position as assistant the plant of the Curtiss-Aero corp. at Garden City, L. I. during the war period to supervisor of finishing operations at of 1917-19. Followed by several years of traveling through New England States and Western New York as sales representative of New York chemical and platers' supply houses. Returning to New York again to assume charge of plating operations at the Sterling Bronze Company and Chesler Hardware Corp. At present is in charge of the Galvano and Plating Departments of the Metallic Art Company of New York City.

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from the delegates, members and friends after the convention is over, for the work accomplished and the time devoted to the task.

There are many problems confronting our Society this year, which is a fine thing for a growing organization. There is nothing to fear in the proposed amendments to the constitution by Chicago and Boston Branches.

This is the fifteenth convention the writer has attended and in that time many changes have been made, all of which have proved beneficial to the Society. At the same time, many proposed changes have been defeated, which have not hindered our growth. The men elected at our Branch meetings as delegates have proved over and over again that they are capable of discriminating between good and bad legislation concerning the A. E. S. and we predict that this year's crop of delegates will be no less capable than those of other years. Let us be fair and frank in our discussions, keeping only in mind the good of our Society, whether we are for or against the proposed amendments.

To our friends inside and outside the A. E. S. whose names we do not often see in print, we extend our sincere thanks. These agencies are a power in the Branches, especially the wives of

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our members, who in many of our Branches make the social events possible. Our advertisers too have helped tremendously during the past year. Let us show our appreciation to them by giving them the preference in purchasing supplies and equipment.

To the Presidents, Branch Secretaries, and officers, we hope to have the pleasure of meeting you all at the Convention and to thank you personally for the achievements of 1936-37.

And now may we have the honor of presenting in this convention number of the REVIEW the names of the founder and the past Supreme Presidents since the Society's inception in 1913. Every member whose name is presented on this list is still living, a remarkable record, and one which makes us truly grateful and extremely proud.

ANNOUNCEMENT

We are pleased to announce that along with any other exhibits which may perhaps be furnished by individual members of the Binghamton-Elmira Branch of the American Electro-Platers' Society, the International Business Machines Corporation will arrange for an exhibit of a Master Clock and a Secondary Clock and Doorlock Recorder in full working and operating order. A major portion of the outside parts of these three units are of a plated finish of one kind or another. In addition, some of the internal working parts of these units have a plated finish.

In order to adequately display this exhibit, arrangements will be made to have the exhibit mounted on an individual stand which may be conveniently shoved against the wall or placed back-to-back with some other exhibits. The exhibit panel itself on which these various units are mounted will require a floor space or its equivalent of approximately 5 x 8 ft. The overall floor space for this panel and the stand on which it is set is estimated at 40 square feet.

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A.E.S.

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1914	Chicago, Ill.	G. B. Hogaboom
1915	Dayton, O.	H. J. Hansjosten
1915	Cleveland, O.	Walter Barrows
1917	St. Louis, Mo.	H. H. Williams
1918	Detroit, Mich.	Walter J. Fraine
1919	Philadelphia, Pa.	Walter J. Fraine
1920	Rochester, N. Y.	O. E. Servis
1921	Indianapolis, Ind.	S. P. Gartland
1922	Cincinnati, O.	Philip Uhl
1923	Providence, R. I.	Walter J. Allen
1924	Milwaukee, Wis.	J. E. Sterling
1925	Montreal, Canada	F. J. Hanlon
1926	Newark, N. J.	E. J. Musick
1927	Toledo, Ohio	F. C. Mesle
1928	Toronto, Canada	John H. Feeley
1929	Detroit, Mich.	Horace Smith
1930	Washington, D. C.	Horace Smith
1931	Rochester, N. Y.	George Gehling
1932	Philadelphia, Pa.	Philip Sievering
1933	Chicago, Ill.	C. A. Van Dereau
1934	Detroit, Mich.	C. A. Van Dereau
1935	Bridgeport, Conn.	H. A. Gilbertson
1936	Cleveland, Ohio	T. F. Slattery
1937	New York City	E. Steen Thompson

American Practice *in* Electroplating*

INTRODUCTION

By GEORGE B. HOGABOOM†

Paper presented at the First International Electrodeposition Conference, organized by the Electrodepositors' Technical Society, at British Industries House, Marble Arch, London, W.1, on March 3rd and 4th, 1937.

THE use of large plants permits methods of operation that would not be economical in small ones, and calls for rapidity in finishing and in electroplating methods. The result is that while the finished products should be of equal quality, too often this is not the case. The cost of production is greater in the small shop where still tanks and hand methods are used than in the larger plants where full automatic equipment for both finishing and plating can be employed. Owing to this difference of cost of hand and automatic operations often the quality of the hand-produced work is not as good as that processed on automatic equipment. The adoption of the greatly needed standards for electroplated coatings will bring about standards for the composition and for the control of the plating solutions and the methods used for production. Then there will be equality of the finished product.

In presenting a story of American practice in electroplating no distinction will be made between hand and automatic methods, and only that which the author has found to be efficient and economical in producing work that will meet the present specifications will be discussed.

SPECIFICATIONS

The American Electro-Platers' Society has had a Research Fellow at the National Bureau of Standards for several years, where under the direction of a Research Committee and Dr. William Blum the metals generally used in the industry have been plated with nickel, chromium, zinc and cadmium by several methods and with varying thickness of deposits. Through the courtesy of the American Society for Testing Materials, the prepared specimens have been exposed to sea-coast, industrial and inland atmospheres so as to ascertain the value of the several coatings for protection against corrosion. Accelerated

*MS. received 27th February, 1937.
†Hanson-Van Winkle-Munning Co., U.S.A.

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tests by the generally known methods were made on similar specimens at the Bureau of Standards.

The tests on steel have been completed except for a few specimens which were run again for confirmation of results obtained. Cast iron and non-ferrous metal specimens, *e.g.*, brass, nickel silver and zinc, both rolled and cast, are now on the test racks. The results will be reported within the next few months, in all probability by June of this year. The tests on steel have been reported in the Journal of Research, National Bureau of Standards. These tests have brought about a change in specifications, especially in those of the automotive industry — the most notable change being a required "average" thickness on significant surfaces and the adoption of a "minimum" thickness for electroplated coatings.

It is recognized that the deposits to withstand outdoor exposure must be heavier and more free from porosity than those in a protected place. The only nickel coating on steel that remained intact for more than two years at all the exposure stations was 0·002 inch thick. It is of interest to note that the requirements of one large automotive manufacturer designates that on the highest class articles the average thickness of the total plate shall be at least 0·002 inch, and the minimum thickness on significant surfaces shall be at least 0·001 inch. The electrodeposit can be all nickel, nickel-copper-nickel or copper-nickel-copper-nickel. The results of the exposure tests on steel indicate that all nickel coatings are the best, and it is probable that this standard will be adopted eventually.

The range of thickness of nickel is from the above to 0·0005 inch and refer to finished or buffed surfaces rather than to parts as removed from the plating tanks.

For zinc and cadmium deposits the duration of the protection of iron or steel in the standard salt-spray is specified rather than the definite thickness of the coating. They must be, however, at least 0·0002 inch thick. This is as it should be, as the character and structure of the deposit of zinc or cadmium have a distinct bearing upon the protection afforded against corrosion.

At present, the salt-spray and the hydrogen sulphide tests are specified, although their limitations are known. There is a distinct need for reliable accelerated tests whose value can be translated into outdoor exposure life.

PRACTICAL APPLICATION

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PREPARATION FOR PLATING

The necessity of absolutely clean work is too well known to discuss in detail. It is being found, however, that while a surface may be chemically clean, it may not be physically clean, *i.e.*, in a condition that will insure a bonding of a non-porous deposit to the basis metal.

Degreasing machines, both the vapour, and the immersion and vapour type, are in general use. This type of cleaning is not sufficient to obtain a non-porous and adherent deposit. The "solids," whether they are dirt, oil residue or metallics, must be removed. This is generally done in an electric cleaner. Where degreasing by the use of organic solvents is not followed the work is put through a "soaking" solution. This can be a solution of neutral soap, or an alkali compound to which a soap or a soap-forming material has been added. This solution emulsifies the mineral oils or greases and may saponify vegetable or animal oils if present. At any rate, a soap is formed which will be congealed on the surface of the work if it is put directly into cold water. The soap film will become an insoluble soap if the work is passed through acid dips, and this acid soap film will prevent the obtaining of a good deposit of metal, especially in a nickel solution. A hot-water rinse is advisable, after which is the electric cleaner. Instead of a "soap soak" the work can be put into an emulsion solvent, *e.g.*, hydrogenated naphtha containing an oil soluble soap.

The best practice is to use two electric cleaners which can be of the same composition and strength. The first cleaning can be done either on steel or brass with the work as the cathode, the second with the work as the anode. The reason for this can be given. Many steels when polished become magnetic, and the finely divided metal particles created by polishing adhere to the surface of the steel. If they are to be removed in an electric cleaner, the polarity of the metallics must be such that they will be released from the surface of the steel by the electric current. If brass is cut down with a tripoli composition containing, for illustration, 65 per cent. abrasive and 35 per cent. grease, it will be found that the residue in the deep recesses has lost much of its grease content, and may contain 95 per cent. "solids" and only 5 per cent. grease.

The "solids" will be found to average about equal parts of

metallics and abrasive. As with steel, if the metallics are to be removed in an electric cleaner they must be charged positively so that they will be attracted electrically to the opposite pole — the cathode. It is not advisable to use a double-throw switch on an electric cleaner, as some metals are soluble in alkali cleaners or colloidal matter may be present, either of which will be deposited on the work when cathode, and there will be stains under or peeling of the electrodeposit.

Steel, after electric cleaning and rinsing in water, should be pickled in acid, either by immersion or with the use of current. Both anodic and cathodic pickling are used. The choice of acids depend upon the work to be processed, hydrochloric and sulphuric acids are used for steel and iron and hydrofluoric or hydrochloric acids for zinc base castings. Brass is generally passed through a weak solution of alkali cyanide to remove any tarnish that may occur in the previous cleaning operations. If the brass is to be nickel plated, a better adhesion of the nickel coating will be obtained if the alkaline film on the work, which is seldom completely removed by the rinse water, is neutralized.

A good nickel coating cannot be produced unless the nickel solution in contact with the surface of the work is acid. If there is a film of alkali on work and the current is on when it is put into the solution, there will be a chemical reaction which may result in a non-adherent deposit or a porous coating due to inclusions of a precipitate.

A nickel solution having a pH value lower than that of the nickel plating solution can be used for a neutralizing solution. If the work is immersed in this solution and transferred to the plating solution, it will then have a film of nickel solution on it as it goes into the nickel plating bath. It is well, also, to neutralize a cyanide copper deposit on steel before nickel plating.

ANODES

Elliptic shape anodes for all plating solutions, except gold and silver, have been generally used, but in alkali solutions these are being replaced by the ball type anodes in spiral wire containers. Ball anodes of copper, brass, zinc, cadmium and tin have proved successful and economical. If a suitable container is found, ball type anodes will be used in acid solutions. With the bar or plate shaped anode there is a constantly diminishing anode area. The

length of the anode is decreased, with the result that the bottom of long articles receive little plate. With the ball type anode and spiral wire container the length of the anode is constant and up to a certain point the anode area increases and never decreases. Scrap is of course, eliminated.

The purity of anodes is recognized as a necessity, and with the development of the rolled "depolarized" (or should they be called "depassified") nickel anodes the lower purity anode is being displaced. It is strange, however, that with the well-known detrimental effect of lead in zinc anodes, that anodes that will not polarize or develop sludge chemically are not more generally adopted. The initial rather than the ultimate cost seems to be a factor.

SOLUTIONS

Nickel solutions operated at room temperature contain about 3 oz. of metal per gallon (22·5 g./l.). Both ammonium and nickel chloride are used. Sodium chloride has been used, but is not now to any great extent. The boric acid content is from 2 oz. to 4 oz. per gallon (15-30 g./l.). A pH value of 5·8 to 6·0 colorimetric has been generally adopted. The current density ranges from 2 amperes to 10 amperes per sq. ft.— for the latter it is advisable to maintain the solution at a temperature between 80° and 90° F.

The well-known "Watts" nickel solution has been a success, and with some modifications is considered the standard solution to-day, when high current densities are employed. In the beginning, 20 amperes per sq. ft. was specified, but now up to 50-60 amperes is used in several plants. In a few plants the solutions are operated at 100 amperes per sq. ft. It is reported that in both outdoor exposure and salt-spray test the better protection is obtained when a current density of not exceeding 60 amperes per sq. ft. is used. This, no doubt, is due to the physical characteristics of the two deposits, which may be corrected as our knowledge of high current density solutions increases. It has been found that temperature and current density bear a close relation to each other. If the current density is increased, the temperature must also be increased. The concentration of the solution is also increased.

In the original Watts bath, the metal content had a range between 6 oz. and 7 oz. per gallon (45-52·5 g./l.); the chloride, as

nickel chloride, about 3 oz. (22·5 g./l.). With the adoption of the high purity anode it was necessary to increase the chloride content to 6 oz. per gallon (45 g./l.). The solutions that are operated at high current densities, *e.g.*, 50-60 amperes per sq. ft., have a total metal content of about 10 oz. (75 g./l.), and the nickel chloride is 9 oz. per gallon (67·5 g./l.). The temperature used is 150°-160° F. The boric acid content has been increased to 5 oz. per gallon (37·5 g./l.). Although the use of boric acid in nickel solutions was brought out about 1878 by an English-born boy who came to America and made a name that is the by-word for electrical measuring instruments — Edward Weston — we know less about its control and its actual function than of any chemical generally used in plating solutions, a fact of which none can be proud.

There is still a difference of opinion as to the relative value of the high and low pH in nickel solutions. It is reasonable to assume that each has its peculiar advantages, and that as further experience is accumulated the good points of each will be recognized and classified. The high pH solution has better throwing power and cathode efficiency, and this limits the low pH solution to the plating of flat pieces, such as radiator shells and bumper bars. In a recent paper on low pH solutions it was stated that a different pH should be used for still solutions. When agitated, the pH of the solution should be slightly higher. The pH values recommended were for still solutions 1·5, and for those agitated 2·3. Good work is being produced in both the high and low pH solutions and both are being operated at about the same concentration, temperature and current density.

For nickel plating zinc or zinc alloys the solution containing sodium sulphate is the one mostly used. It has been found that much of the trouble experienced with cracking and peeling of the nickel deposit was due to the amount of zinc present in the nickel solution. While no definite data is available, it is considered that the maximum zinc content must not be more than 0·01 oz. per gallon (0·075 g./l.). When it reaches that point the solution is "purified" by the nickel carbonate or ferrous sulphate method. The necessity for the purification of the solution is recognized and followed in plants where quality and quantity of production are essential. While in some plants the nickel is deposited directly on zinc it is considered more advisable to deposit from

a cyanide solution a copper coating of from 0·0002 inch to 0·0004 inch thick. This method has been followed for several years, and has proved quite staisfactory.

To even mention bright nickel solutions is to invite discussion. There are several processes recommended, and all have been tried in the laboratory, in the small shop and on large production scale. Each process has a property that is peculiar to itself, and which permits certain classes of work under definite conditions to be produced satisfactorily. It would seem natural for me to say that the nickel-cobalt solution gives the best results consistently both in small and large units. This statement, however, is fair. A British investigator found that the deposit was equal in physical characteristics to those obtained from the regular white nickel solutions when tested by the method he developed. It is also significant that it is the only bright nickel solution that can be controlled completely by chemical analysis — including the addition agents for obtaining the bright plate. That in itself places the nickel-cobalt process in more logical position than that of any other process, and is in keeping with the objects of this conference — a better and more complete knowledge of electroplating processes.

COPPER

The acid copper solution is used in a few plants as an intermediate plate in nickel — copper-nickel coatings. There has been no change made in the metal or sulphuric acid content — 6-8 oz. (45-60 g./l.) metal and 6-8 oz. (45-60 g./l.) sulphuric acid and no new addition agents.

In electrotyping higher current densities are being employed. the discovery of the addition of phenol sulphonic acid suggested current densities up to 200 amperes per sq. ft. It was found, however, that when that current density was used the composition of phenol sulphonic acid was changed and hydroquinone was formed. That had a different effect upon the character of the copper deposit. At one plant semi-automatic plating nachines were installed, thus not only obtaining agitation by air, but also by keeping the cathode moving into less depleted areas of solution and bringing the work before each anode regardless of its size, it was found that from 100 to 150 amperes per sq. ft. could be used, and a deposit still obtained with the

crystal structure and strength desired without the use of any addition agent.

The cyanide copper solution seems to rebel against any radical change. The use of higher current densities or higher temperatures, or the combination of both these, with an increased metal content brings about the formation of carbonate which effects both anode and cathode efficiency. The present solution can be operated from 15 to 20 amperes per sq. ft. at a temperature of 100° F. No data is available as to whether a solution is made more efficient if the metal content is increased above that recommended for still plating.

Several years ago, Dr. O. P. Watts suggested the use of Rochelle salts in brass and copper solutions. A copper cyanide solution containing from 6 oz. to 8 oz. of Rochelle salts per gallon (45-60 g./l.) is giving good results. The metal added as cyanide of copper content can be from 2 oz. to 5 oz. per gallon (15-37.5 g./l.), the "free" cyanide should not exceed one-half ounce per gallon (3·75 g./l.). A current density of up to 40 amperes per sq. ft. can be used if the temperature is maintained between 140° to 150° F. The structure of the deposit is excellent and in many cases a bright nickel coating is put on without previous buffing of the copper. This is of particular advantage in the plating of zinc base die casting with copper-nickel deposits. There is no formation of carbonates, and so far as known at present no detrimental products are formed through electrolytic decomposition of the Rochelle salts. The solution should be contained in a rubber-lined steel tank. A steel tank may be attacked with the consequent formation of ferro cyanides which add to the resistivity of the solution and interfere with the estimation of free cyanide with silver nitrate. The pH of the solution should be maintained at about 11·3 colormetric. One plater reports that at 11·3 the cathode efficiency is above 80 per cent., while at 12·5 it is as low as 35 per cent. This solution is worthy of more detailed study.

BRASS

The improvement of brass plating solutions has been with those used for plating steel for rubber coating rather than solutions for ornamental finishes. Brass deposits other than those that assay 70 per cent. copper and 30 per cent. zinc are not suitable for protecting steel from the action of the component parts of rubber

in vulcanization. To obtain a definitely adherent coating of rubber on steel, such as used for motor supports, etc., the brass must have a 70 : 30 copper-zinc ratio. The brass-plated articles must be protected against tarnish between the time of plating and of coating with rubber. This is done by "lacquering" the brass plated parts with a thin rubber cement or with a weak solution of gum cumar. A paper giving in detail the composition and operation of a brass solution for this special process was read at the June, 1936, convention of the American Electroplaters' Society.[1]

ZINC

The electrozinc plating of wire by the "Tainton" process awakened the plater and electrochemist to the posibility of operating solutions at current densities that seemed not only impractical, but impossible. It is routine practice to deposit zinc on wire at the rate of 0·001 inch per minute or around 1,000 amperes per sq. ft. Runs of 1,500 amperes per sq. ft. have been made. There is every indication that steel in continuous sheet form will soon be plated at current densities comparable with what is being used for wire. A very unique tank will be used to permit the sheet being plated vertically, that is on its edge. The anodes in this process are insoluble. The use of soluble zinc anodes which will permit the use of high current densities is practical. Anodes that will not polarize and which will corrode without any sludge have been developed. With them a constant electrical pressure can be used, thereby maintaining the current density at any desired point. The pH of the solution will change only slightly more than the pH of a nickel solution. With these conditions controlled, it is not difficult to obtain consistent results.

There was a demand for bright zinc solutions after the cadmium situation indicated that there would be a shortage of that metal. The electroplater met this demand, and cyanide zinc solutions from which bright deposits can be obtained are in general use. The unseen advantage of the permissible use of higher current densities than formerly used on cyanide zinc solutions increased the commercial value of the bright plating solution.

No comparison will be made between the value of cadmium *v.* zinc. Each has its respective value. For long life ornamental value cadmium deposits are better than zinc.

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(1) Dr. H. P. Coats. American Electro-Platers' Soc., June, 1936.

The American Practice of Cadmium and Silver Plating are treated by Dr. Soderberg and Mr. Mesle respectively.

TIN

The electrodeposition of tin is receiving considerable attention in this country. There are in development commercial processes for the coating of strip steel to compete with the present hot tin-dip methods used on small sheets. There is no doubt that very high current densities will be used — just how high is difficult to predict — as a guess, however, it is believed 500 amperes per sq. ft. will be used. The composition of the solutions used have not as yet become generally known. They contain addition agents for which the electroplating industry is indebted to the organic chemist.

The work of Mr. Macnaughtan with the sodium stannate solutions needs only well merited commendation.[2] The only difference in operation, if reports are read correctly, is the use of soluble tin anodes instead of nickel. The present successful anode is of the ball type used in spiral wire containers. The success of these anodes depends upon the anode current density. This must be kept at a value where there is sufficient oxidizing action, at the anode, to convert the stannite salts into the stannate as rapidly as they are formed. In this way the anode can be kept clean, the metal concentration of the solution maintained, a cathode current density of up to 40 amperes per sq. ft. used, and a fine-grained, dense deposit of tin obtained consistently. The need of additions of hydrogen peroxide is eliminated. This makes the operation of the solution more satisfactory, and produces continuously deposits of excellent quality.

CONCLUSION

The future holds much promise for the rapid development of the electrodeposition of metals. Current densities that were deemed fanciful will be used for commercial production. It is predicted that the success of these new developments will be in the maintenance of the metal content of the solution with anodes that will not polarize, the constant agitation by mass flow of the electrolyte, continuous filtration and refrigeration to keep the solution at a pre-determined temperature.

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(2) J. Electrodepos. Tech. Soc., 1934, 9, 101.

In Memory of our Friend and Brother

We are meeting here this evening,
As we've met so oft before,
To discuss our plating problems
Of which we always have a score.

But, as I scan the faces
Of you fellows here tonight,
I am missing one familiar —
One forever gone from sight.

I refer to Patrick Sheehan,
Our mentor and our friend,
Who has left life's cares behind him
Who has reached the journey's end.

Good old Pat — we all have known him
On this spot we've seen him stand.
Always cheerful, always willing,
Ready with a helping hand.

No job too big, no job too small —
You all have noticed that
Experiments or production,
It was all the same to Pat.

A Charter member of Milwaukee Branch
He helped build the A. E. S.
As President and Librarian —
An able officer, you must confess.

As a plater and a chemist
He was rated with the best;
Also did his share of research work
And has reached a well earned rest.

He is gone but not forgotten
Memories dear our thoughts enfold;
With us still his spirit lingers,
Helping, guiding as of old.

And now, before we finish
With our business here tonight,
Let us rise and bow our heads in prayer
For Pat — who has passed from sight.

By MRS. F. W. HAU,
Racine, Wis.

Read at the Smoker, Milwaukee Branch of the A. E. S., Hotel Schroeder, April 24, 1937.

Calcium Chloride Corrosion *of* Plated Automotive Parts *can and should be* Reduced

By EDWIN M. BAKER*
and
HOWARD R. WILSON**
Read at Cleveland 1936 Convention

DURING the past decade, the quality of plated products exposed to the weather has been undergoing steady improvement. Ten years ago the average total thickness of electroplate on automobile parts was well under 0.0005 inches with a number of parts having plates thinner than 0.0002 inches and only a few approximating a thickness of 0.001 inches.

In the last decade chromium has been applied as a surface finish, but various researches[1] have shown that chromium serves primarily to protect the underlying nickel from tarnishing and that reliance for rust protection must be placed in the underlying nickel or underlying copper and nickel deposits. It is our belief that, during the last few years in particular, the average quality of plate has been more nearly uniformly high than in any other period of the automotive industry. The average car owner in our large northern cities, and particularly in Detroit, has probably entertained the erroneous view that the quality of plating has been poor during the past few years, and especially during the winter of 1935-36. His belief would be based on the performance of automotive parts on a new car which he may have purchased in the summer or fall of 1935 and which, in all probability, show more or less rust. The reason for more trouble with plated parts during the past year is more severe man-made weathering conditions. The past year has been characterized as an unusually severe winter with the streets coated with snow and particularly ice, for unusually long periods of time. This has created a traffic hazard which has been met in the larger cities by liberally sprinkling a mixture of sand and

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** Graduate School, University of Michigan.
1. E. M. Baker and W. L. Pinner, J. Soc. Auto. Engs. March, 1928, U. S. Bureau of Standards, Journal Vol. 13, Sept. 1934.

calcium chloride on the streets, particularly at street intersections. Consequently, during the past winter, plated parts on the outside of automobiles have been subjected to several months corrosion by calcium chloride solution splashing up from the road.

Five or six years ago, a number of investigations were made on the effect of calcium chloride on chromium plated articles. The resistance of chromium plate in a calcium chloride spray has been studied by H. C. Mougey[2] of the General Motors Laboratories and cases were noted where the chromium plate was dissolved by the chemical action set up at the surface. Mougey believes that this action is of consequence only during the winter when calcium chloride is used to thaw ice and is then present in greater concentrations than would result from the use of calcium chloride on dusty roads in summer. Either dilute, very concentrated solutions, or solid calcium chloride exposed for a long period to the air must come to equilibrium with the formation of strong solutions, the concentration depending on the temperature, and the humidity of the air. Presence of snow or rain water would result in more dilute solutions until evaporation could bring the solution again to the equilibrium concentration.

However, the amount of calcium chloride in solution in contact with a square inch of metal surface is undoubtedly greater under winter conditions. In summer a given amount of solution would be spread over a comparatively large quantity of dirt or road mud. Thus, the chance of the effective concentration at the metal surface being great enough to attack the chromium plate would seem to be greatest under winter conditions. Other factors probably enter, such as the rate of reaching the equilibrium between the solution and the water vapor in the air, change of pH of the solution due to absorption of CO_2 or O_2, differential aeration effects when solid matter is present on the surface, amount of hydrolysis and activity of solutions at different temperatures and concentrations, and even such indeterminate factors as change in weather conditions and amount of

2. Calcium Chloride Testing of Electroplated Deposits, Trans. Am. Electrochem. Soc. 58 265 (1930).

salt applied per unit area of the street, the amount of drainage and the nature of the road surface.

Mougey states, "Since winter conditions are so much more severe than summer conditions, our attention should be directed to the winter conditions. If these troubles are solved, the summer troubles will automatically take care of themselves."

Considerable research has been devoted to methods of producing chromium plated surfaces which would be more resistant to calcium chloride. Heat treatment of the deposit was investigated by R. J. Wirshing[3] of the General Motors Laboratories, and a seven-fold improvement was obtained. Removal of hydrogen was suggested as the reason, but the formation of a thicker, more passive oxide film probably took place during the heat treatment.

In 1931 and 1932 the authors decided to investigate the substance which is apparently the cause of most of the trouble, namely calcium chloride, and if possible to devise a remedy. Some people and organizations had advocated stopping the practice of sprinkling calcium chloride on the streets. They were met with the well-taken reply that safety of life and limb was more important than the rusting of parts on automobiles. The remedy, if there was to be one, evidently must take the form of a cheap material which would be effective in melting ice and which, at the same time, would cause a minimum of corrosion of plated parts. The authors felt that their investigation had at least pointed the way to a remedy, but interest in the subject had seemed to lag. In view of conditions as they existed this past year, it now seems apropos to make the results of this earlier investigation available to all so that some benefit may eventually accrue to the users of automobiles as well as to the electroplating industries.

Chromates have been used as inhibitors of corrosion with some measure of success in the refrigerating industry. A good discussion of the subject is found in "Causes and Prevention of Corrosion."[4]

U. R. Evans[5] discusses the action of chromates and suggests

3. Heat Treatment of Chromium Deposits to Increase their Resistance to Corrosion. Trans. Am. Electrochem. Soc., 58, 251 (1930).
4. F. N. Speller. McGraw Hill Book Co., New York City.
5. Ulick R. Evans: The Corrosion of Metals, p. 112. Edward Arnold and Co., London, 1926.

that their use as inhibitors is less apt to result in localized corrosion of iron by chlorides than the use of alkalis such as the hydroxides or carbonates. He has given special study to an effect which he terms "differential aeration" and has shown that electrolytic currents may be set up when two adjacent portions have unequal access to oxygen, such as would occur at pits or recesses.

EXPERIMENTAL WORK

Three types of coatings were included in the tests. Sections of commercially plated tire covers, coated with nickel only, and with nickel followed by chromium plate; and also sections of bumper bars coated with successive layers of nickel, copper, nickel and chromium.

Three samples of calcium chloride were obtained — calcium chloride C.P., and two commercial brands which will be designated as commercial (a) and commercial (b). Magnesium chloride C.P., and sodium chloride C.P. were also used.

A method of testing was required that would allow the solutions to remain on the surface of the plates so that some drying of the film of solution would take place and so that the film might be brought in equilibrium with air. The effect of air on the pH of calcium and magnesium chloride brines was mentioned in the discussion[6] of the paper by H. C. Mougey. The salt spray method of testing is usually the most satisfactory test for plated work, but was not used in this research because the high humidity of the air in the spray box would not allow the solution to become as concentrated by evaporation as a film of salt solution exposed to ordinary atmospheric conditions.

The intermittent immersion test seemed to furnish the desired conditions and was used for two series of tests. The time cycle adopted was somewhat shorter than desirable, but was used because of limitations of the available equipment. During a period of three minutes the test pieces were immersed and withdrawn from the solution and then were exposed to the atmosphere for nine minutes before being again immersed. The temperature of the air varied between 75° and 85° F. Since we desired only comparative results we did not control either temperature or humidity.

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6. Trans. Am. Electrochem. Soc. Vol. **58**, 270 (1930).

Short lengths, 6″ by $1\frac{3}{4}$″, were cut from chromium plated bumper bars, carefully wiped free from grease, cleaned first in carbon tetrachloride, then in an alkaline cleaner, rinsed, lightly scrubbed with very fine, wet pumice stone and rinsed again. The cleaning was repeated if necessary until the bars were free from "water break" when dipped in distilled water. Immediately after the hot alkaline cleaning the cut edges were dipped in molten paraffin to prevent action on the bare steel. The pieces were stored for a short time under distilled water until all samples were clean and then were suspended on the test rack so that as the rack was lowered one bar would be immersed in each of the solutions listed in Table I.

Table I

COMPOSITION OF SOLUTIONS USED IN INTERMITTENT IMMERSION TESTS

All solutions are 3 Normal in chloride content. (14.2 oz. Cl per gal.)

Solution Number	*Salt*	*Grade*	g./l.	*Additions*	*Purpose*	*pH*
A-1	Calcium chloride	C.P.	237			7.4
A-2	Magnesium chloride	C.P.	305			6.4
A-3	Sodium chloride	C.P.	175			6.8
A-4	Calcium chloride	Commercial (a)	211			8+
A-5	" "	Commercial (b)	207			8+
A-6	" "	C.P.	237	HCl	Reduce pH	6.0
A-7	" "	C.P.	237	$Ca(OH)_2$	Increase pH	8+
A-8	" "	Commercial (b)	207	$Na_2Cr_4O.10H_2O$ 10 g/l	Inhibitor	
A-9	" "	Commercial (a)	211	$Na_2CrO_4.10H_2O$	"	
A-10	" "	C.P.	237	$Na_2CrO_4.10H_2O$	"	
A-11	" "	C.P.	237	$Na_2CrO_4.10H_2O$	"	
A-12	" "	C.P.	237	$Na_2CrO_4.10H_2O$	"	

Measurements of pH were taken with a quinhydrone electrode so that values above pH8 are not recorded beyond one significant figure. No attempt was made to measure the pH of any of the solutions subsequent to the addition of chromate because oxidizing agents interfere with this method of measurement.

In these tests visual inspection of the surfaces was the only practical method of judging the progress of corrosion. The

following abbreviations and symbols have been employed in recording data and tabulating it for ready visualization of results:

F denotes the *face* of the bar, polished and buffed
E denotes the *edge* of the bar, dull plate on tumbled surface
B denotes the *back* of the bar, dull plate on tumbled surface

Table II

SYMBOLS USED TO DESCRIBE PROGRESS OF CORROSION

Abbreviation	*Symbol*	*Meaning*
P	Blank Space	Perfect, no rust visible to naked eye
VSR	Period .	Very slightly rusty, just visible to naked eye
SR	Colon :	Slightly rusty, 2-3 spots about 1 mm. diam.
NR	o	Noticeably rusty, 2-3 spots 2-3 mm. diam.
VNR	8	Very noticeably rusty, several spots 5 mm. diam.

These symbols are used in Table III to save space and make possible the representation on one page of all of the observations made throughout each series of tests. (See page 457 for Table III.)

The plot for each car in Table III furnishes at a glance the relative condition of the face, edge and back surface of each bar on each day of the test. Those bars which presented the best appearance on all surfaces throughout the test and have the highest rating are represented by the "cleanest slate." The symbols serve as a compact graphic code in place of writing P, VSR, etc.

The solid, dark coating on Bar 10 is precipitated calcium chromate formed because too much inhibitor was added to the solution. It has been partially removed from the surface in order to show the condition of the plate after the test.

Bar 1 exhibits several spots below the immersion line and large areas near the immersion line. These are not ordinary red, iron rust spots. They are areas where the chromium has been dissolved by a variety of corrosion which probably corresponds to that reported by H. C. Mougey. It is accompanied by the formation of a green film which spreads from a small corrosion center consuming the chromium plate as it advances. Since this effect was not produced by the other two chlorides this action seems to be characteristic of calcium chloride solutions in contact with chromium plate.

The important things which this test brings out are:

In this test sodium and magnesium chlorides were less active in promoting corrosion than calcium chloride.

Differences in the corrosion caused by C.P. and commercial calcium chlorides are minor and may be characterized as insignificant.

Corrosion did not vary consistently with variation in pH.

The addition of sodium chromate in the concentrations used was uniformly effective in markedly reducing rusting and in preventing dissolution of the chromium plate.

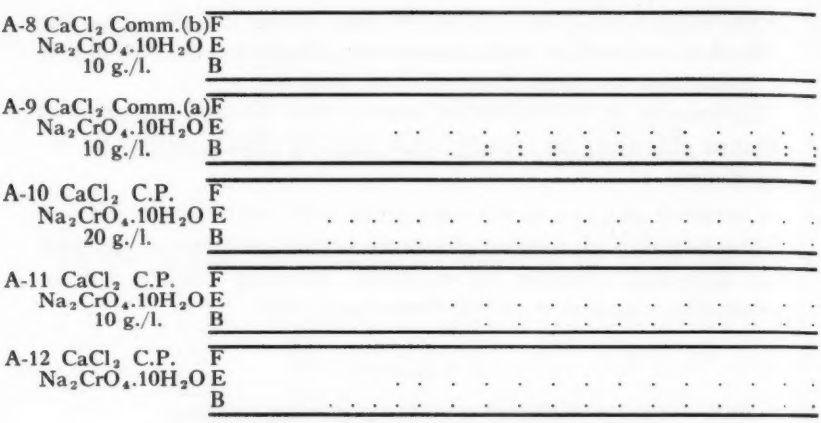
Table III

COMPARATIVE ACTIVITY OF SOLUTIONS IN PROMOTING CORROSION AS MEASURED BY INTERMITTENT IMMERSION TESTS

Series A

Graphical Representation of Daily Observations — Size of Symbol Increases as the Extent of Rusting Becomes Greater Showing Relative Position on an Arbitrary Scale of Magnitude — Blank Space Means Perfect Condition.

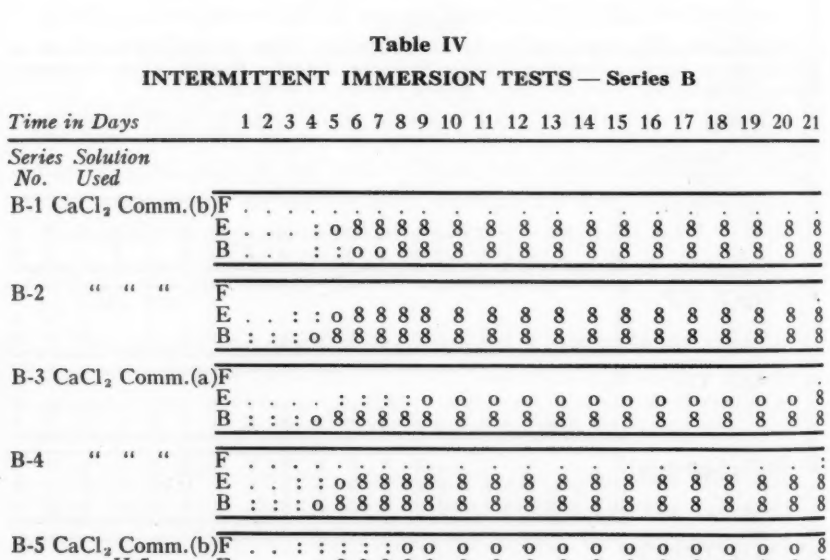
Time in Days		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Series No.	*Solution Used*																					
A- 1	$CaCl_2$ C.P.	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		E	:	:	:	o	o	o	o	o	o	o	o	o	o	8	8	8	8	8	8	8
		B	.	:	:	o	o	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
A- 2	$MgCl_2$ C.P.	F																				
		E	.	.	.	:	:	:	:	:	:	:	:	:	:	:	:	:	:	o	o	o
		B	:	o	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
A- 3	NaCl C.P.	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		E					.	.	.	:	:	:	:	:	:	:	:	:	o	o	o	8
		B	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
A-4	$CaCl_2$ Comm.(a)	F	.	:	:	:	:	:	:	o	8	8	8	8	8	8	8	8	8	8	8	8
		E	:	o	o	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		B	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
A-5	$CaCl_2$ Comm.(b)	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		E	:	:	:	:	:	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
		B	:	:	o	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
A- 6	$CaCl_2$ C.P. pH 6	F					.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		E	.	:	:	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
		B	.	.	:	o	o	o	o	o	o	o	o	o	o	o	o	8	8	8	8	8
A- 7	$CaCl_2$ C.P. pH 8	F																				
		E			:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		B	.	.	.	o	o	o	o	o	o	o	o	o	o	o	o	8	8	8	8	8

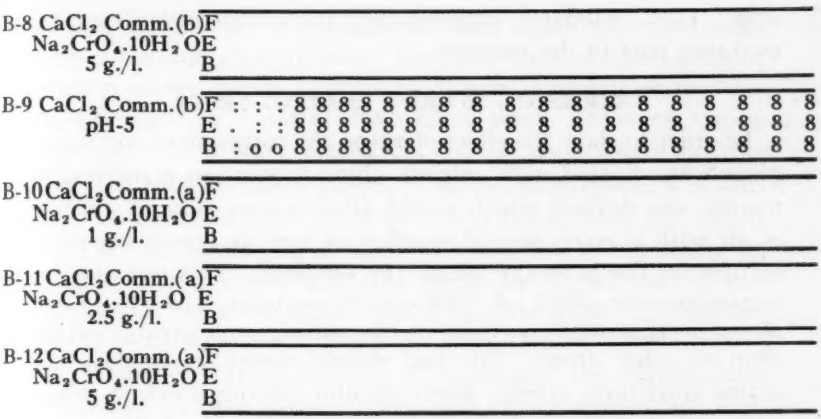

A-8 $CaCl_2$ Comm.(b) $Na_2CrO_4.10H_2O$ 10 g./l.
A-9 $CaCl_2$ Comm.(a) $Na_2CrO_4.10H_2O$ 10 g./l.
A-10 $CaCl_2$ C.P. $Na_2CrO_4.10H_2O$ 20 g./l.
A-11 $CaCl_2$ C.P. $Na_2CrO_4.10H_2O$ 10 g./l.
A-12 $CaCl_2$ C.P. $Na_2CrO_4.10H_2O$
F E B

F = *Face* of Bar E = *Edge* of Bar B = *Back* of Bar

Table IV

INTERMITTENT IMMERSION TESTS — Series B


Time in Days 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Series No. Solution Used
B-1 $CaCl_2$ Comm.(b)
B-2 " " "
B-3 $CaCl_2$ Comm.(a)
B-4 " " "
B-5 $CaCl_2$ Comm.(b) pH-5
B-6 $CaCl_2$ Comm.(a) $Na_2CrO_4.10H_2O$ 1 g./l.
B-7 $CaCl_2$ Comm.(b) $Na_2CrO_4.10H_2O$ 2.5 g./l.
F E B



F = *Face* of Bar E = *Edge* of Bar B = *Back* of Bar

The second series of tests was made to determine to what extent rusting and corrosion would be prevented with lower ratios of inhibitor to chloride. The results are reported as Series B, Table IV. The compositions of the solutions, which were made up in the same manner as in the previous test, are given after the series number. The bars were prepared in the same way as before.

The pronounced effect of the addition of the inhibitor to the commercial brands of calcium chloride is shown by the fact that all rusting was prevented on all surfaces of those bars immersed in solutions containing even as little as 1 g. of chromate per liter of solution.

On those bars immersed in solutions containing no inhibitor there was, at the immersion line, areas covered by green corrosion as in the previous tests, but this effect was not appreciable on those samples where chromate was present in solution.

Since this form of corrosion occurs mainly above the immerison line where salt is present in small crystals due to the familiar "creeping" action, it is believed that the corrosion is the result of electrolytic currents set up by inequality of concentration of solution on the plated surface.

It has been suggested that hydrolysis of calcium chloride gives rise to the formation of calcium oxychloride and hydrochloric

acid. H. C. Mougey[7] suggests that the carbon dioxide in the air takes part in the reaction.

SERIES C — SLURRY COATING TESTS

In order to show the effect of air on the corrosion of chromium plate when coated with calcium chloride solution a method of testing was devised which would allow a long time of contact of air with a given film of solution as well as presenting more surface for the action of air on the solution. This test also incorporates the effect of "differential aeration," i.e., access of air to certain small portions of the surface to a greater extent than at other areas. The test should therefore simulate the actual conditions present when calcium chloride solution mixed with soil or mud is splashed on plated surfaces and allowed to remain there and come to equilibrium with the atmosphere.

An inert porous material was desired which would have a large amount of surface and be capable of holding much solution. The most satisfactory substance appeared to be diatomaceous earth. A slurry was made by adding 250 grams of Sil-O-Cel to a liter of 3 normal calcium chloride solution. A similar suspension was made using a 3 normal solution of calcium chloride containing also 0.5 g. per liter $Na_2CrO_4.10H_2O$, or an amount of sodium chromate equal to about $\frac{1}{4}$ per cent of the dry calcium chloride present.

Samples cut from chromium plated bumper bars were cleaned until free from water break and dipped in each of the above suspensions, removed and stood on end in a beaker which was as tall as the sample. A fairly uniform coating of slurry was left on the surfaces of the samples. In three hours green spots of corrosion were spreading on bar C-1, which was the sample coated with slurry containing no inhibitor, and after four days about 10 per cent of the chromium plate surface was covered with a green corrosion film.

No corrosion was evident on C-2 after ten days, this sample having chromate present in the slurry coating. Both samples remained quite moist as long as they were kept in the beakers. The tops of the beakers were open to the air.

When the slurry on C-1 was rinsed off and the green film was scrubbed away the chromium plate was absent wherever the

7. Trans. Am. Electrochem. Soc., 58, 269 (1930).

film had spread. It was suggested that small holes or cracks in the chromium plate initiated the formation of these spots of corrosion either due to couples of dissimilar metals or to "differential aeration." After four days small drops of strong hydrochloric acid were placed on C-1 in areas where no corrosion had thus far taken place. The chromium plate was thus locally removed at three small spots and the surplus acid rinsed off. This bar was again covered with the slurry containing no inhibitor. In this way a couple would be formed and it was thought that corrosion would start near these areas. No noticeable corrosion took place during six days at these areas.

As a further test of this line of reasoning, two sample bars were abraded with a file, scratched with emery, holes made with a small drill and a few minute pits made with a fine sewing needle. One of these test bars, C-3, was coated with slurry containing no inhibitor, and C-4 was coated with slurry containing 0.5 g. of sodium chromate per liter of solution.

Green corrosion started to form on C-3 after three hours, but not at those places where the plate had been punctured. After three days about ten per cent of the surface was corroded. C-4 showed no corrosion during seventeen days, but on the next day about three per cent of the total area was covered with green corrosion. This probably resulted from a sudden increase in the temperature and humidity of the atmosphere, during early summer. Apparently the rate of corrosion could be greatly increased if the tests were conducted in a room in which the temperature and humidity were maintained considerably above ordinary atmospheric conditions.

Further tests demonstrated that chromate must be present in the calcium chloride solution on the plated surface if corrosion is to be inhibited. Thus, protection produced by chromates is soon destroyed by chloride solutions containing no chromate. It was also apparent that corrosion started by contact with chloride solution containing no inhibitor could be arrested by placing the surface in contact with chloride solution containing sodium chromate.

SERIES D — SLURRY COATING TESTS

In all of these slurry coating tests where corrosion took place

the corrosion centers formed chiefly along the edges of the test pieces. It was at the edges that the plating was most apt to be rough and to show microscopic pores or pits. Since those pits produced intentionally by mechanically puncturing the plate did not cause the formation of new corrosion centers, it was suggested that small amounts of metal salts from the plating baths might be occluded in the surface structure and serve as accelerators of corrosion.

In Series D, the action of several common metal salts has been studied, the salts being confined to small local areas on the surface. These tests did not indicate that the metal salts might in general be factors in the initiation of new corrosion centers.

Table V

Description of Samples	*Composition of Slurry*
E-1 Section of chromium plated tire cover 4″ x 6″	One liter of calcium chloride, 3 N. in chloride, and containing 250 grams of Sil-O-Cel as suspension. No inhibitor. Designated as Slurry E-1 in Table VI.
E-2 Section of chromium plated tire cover 4″ x 6″	Same as above except that there was present 0.5 gram of $Na_2CrO_4.10H_2O$ in one liter of solution. Designated as Slurry E-2 in Table VI.
E-3 Section of nickel plated tire cover 4″ x 6″	Same as E-1.
E-4 Section of nickel plated tire cover 4″ x 6″	Same as E-2.
E-5 Section of chromium plated bumper bar $1\frac{3}{4}$″x5″	Same as E-1.
E-6 Section of chromium plated bumper bar $1\frac{3}{4}$″x5″	Same as E-2.
E-7 Duplicate of E-5	Same as E-1.
E-8 Duplicate of E-6	Same as E-2.

SERIES E

SLURRY COATING TESTS AS CONSTANT TEMPERATURE AND HUMIDITY

This series was intended as a confirmation of the fact that chromates act as inhibitors of corrosion and to eliminate the irregularity of results occasioned by temperature and humidity changes in previous tests. Series E tests were carried out in a room where the temperature was held at 85° F. and the humidity at about 65 per cent relative humidity.

Throughout this series of tests the slurry coatings were not removed by rinsing because in preliminary experiments it was noticed that this procedure usually halted the spread of corrosion

from the original centers. Furthermore, no corrosion was ever found under the slurry after rinsing that was not previously evident as a green coloration in the slurry, sharply defining the limits of the corrosion areas. Red rust areas appeared as red colored spots in the coating.

It is evident that the chromate did not completely prevent corrosion of samples E-5, 6, 7, 8 after one week, but samples E-6 and E-8 show a remarkable decrease in the rate of spreading of the green corrosion film. It was noted that corrosion started at one edge of the bar. Investigation showed the plate to be thinner at this edge.

Table VI

SLURRY COATING TESTS
AT CONSTANT TEMPERATURE AND HUMIDITY

Series E

The extent of corrosion is recorded as the percentage of chromium plated surface covered by green corrosion films spreading on the sample as approximated by visual inspection. The average diameter and number of spots was estimated and from this the percentage of area computed, except where too small or irregular.

Time		3 *hours*	1 *day*	2 *days*	3 *days*	4 *days*	5 *days*	6 *days*	7 *days*
Dry bulb °F.		85	85	83	85	85	84.5	85	84.5
Wet bulb °F.		75	78	73	77	75	75	75	75
Sample	*Slurry*	*Area*	*Area*	*Area*	*Area*	*Area*	*Area*	*Area*	*Area*
E-1	e-1 No inhibitor.	Few small spots	More small spots	More small spots	5%	6%	8%	8%	10%
E-2	e-2 Chromate added	0%	0%	0%	0%	0%	0%	0%	0%
E-3	e-1	Few small spots	More spots	Same	50%	100%	100%	100%	100%
E-4	e-2 Chromate added	0%	0%	0%	0%	0%	0%	0%	0%
E-5	e-1 No inhibitor.	Few small spots	More at edge	Rust on back	30%	50%	60%	75%	85%
E-6	e-2 Chromate added	0%	0%	0.5%	4%	4%	5%	10%	15%
E-7	e-1	Few small spots	More at edge	Rust on back	30%	50%	60%	75%	85%
E-8	e-2 Chromate added	0%	0%	0.5%	4%	4%	5%	10%	15%

Table VII

Series F

Description of Samples	*Composition of Slurry*
F-1 Section of chromium plated bumper bar 1¾"x5"	F-1 Identical with E-1
F-2 Section of chromium plated bumper bar 1¾"x5"	F-2 Same as E-2 except sodium bichromate used in place of chromate
F-3 Duplicate of F-1	F-1
F-4 Duplicate of F-2	F-2
F-5 Section of chromium plated tire cover 4" x 6"	F-1
F-6 Section of chromium plated tire cover 4" x 6"	F-2

Table VIII

SLURRY COATING TESTS AT CONSTANT TEMPERATURE AND HUMIDITY

Series F

The extent of corrosion is recorded as the percentage of chromium plated surface covered by green corrosion films spreading on the sample as approximated by visual inspection. The average diameter and number of spots was estimated and from this the percentage of area computed, except where too small or irregular.

Time in Days		1	2	3	4	5	6	7
Dry bulb °F.		85.5	85	85	84.5	84	84	84
Wet bulb °F.		75	76	76	76	75	75	75
Sample	*Slurry*	*Area*	*Area*	*Area*	*Area*	*Area*	*Area*	*Area*
F-1	f-1							
	No inhibitor	12%	25%	30%	30%	50%	50%	50%
		0%	0%	0%	2%	3%	3%	3%
F-2	Chromate added							
F-3	f-1							
	No inhibitor	12%	20%	30%	30%	50%	50%	50%
F-4	f-2	0%	0%	2%	2%	3%	3%	3%
	Chromate added							
F-5	f-1							
	No inhibitor	1%	2%	4%	4%	6%	6%	6%
F-6	f-2	0%	0%	0%	0%	0%	0%	0%
	Chromate added							

This serves as evidence to show that this slurry coating test actually does bring out the weak points in a protective coating on metal. It is also an accelerated test.

SERIES F — SLURRY COATING TESTS AT CONSTANT TEMPERATURE AND HUMIDITY

This series was carried out to determine if a higher concentration of chromate ion would prevent corrosion at 85° F. and 65 per cent relative humidity.

By substituting 0.5 gram of sodium bichromate for 0.5 gram of sodium chromate, the hexavalent chromium present will be

increased 2.2 times. The cost of hexavalent chromium would probably be less if purchased in the form of sodium bichromate.

The results of these tests are recorded in Table VIII. The concentration of chromate was not sufficient to stop all corrosion but the rate was very much reduced. The amount added was in this case equivalent to about 0.25 per cent of the weight of calcium chloride.

The solubility of calcium chromate is much lower in alkaline solutions of calcium chloride than in neutral or slightly acid solutions. Dry calcium chloride which was alkaline and contained sodium chromate formed a precipitate of calcium chromate as water was absorbed making a concentrated solution of chloride. As the calcium chloride diffused out into Sil-O-Cel or filter paper the concentration of soluble chromate was low.

This factor was tested in Series G where chloride with and without $\frac{1}{4}$ per cent of sodium chromate was placed in the center of test plates coated with a dry coating of Sil-O-Cel. As the chloride absorbed water, it diffused out over the surface of the plates. The greater portion of the chromate remained as calcium chromate at the center of the plate and corrosion was not inhibited where the calcium chloride had covered the surface by diffusion. At the end of seven days all samples were corroded about equally to the extent of about 6 to 7.5 per cent of the plated area, so that chromate added in this way to alkaline calcium chloride is not satisfactory.

It was found that by adding a small amount of hydrochloric acid or an acid salt to neutralize the alkalinity of the commercial calcium chloride and then evaporating with $\frac{1}{4}$ per cent of sodium chromate added, a product could be crystallized out which did not form a precipitate of calcium chromate as it absorbed water and diffused out into porous material.

The question investigated next was the corrosive action of calcium chloride containing chromate prepared in this way.

Series H consisted of samples of chromium plated tire covers coated with a slurry containing calcium chloride and other samples coated with slurry containing the crystallized acidified mixture of calcium chloride and dichromate. At the end of nine days the two samples coated with slurry containing the mixture of calcium chloride and dichromate were only 0.7 to 2.9

per cent corroded while the two samples coated with slurry containing the untreated calcium chloride were 22 to 22.1 per cent corroded.

Thus, it would appear that even though it is necessary to add sodium chromate to calcium chloride by crystallizing from a neutral or slightly acid solution the product obtained is much less corrosive toward chromium plate than the untreated alkaline calcium chloride.

CONCLUSION

These laboratory tests have indicated that chromates serve as effectual inhibitors in the corrosion of steel plated with nickel and chromium when chloride solutions are present on the surface in thin films, either with or without finely divided inert material being present. It has been found that chromates are particularly effective in reducing the corrosion of the chromium metal itself by the action of calcium chloride.

A marked decrease in the extent of rusting of automobile hardware exposed to spattering of road material should be brought about if the use of calcium chloride containing inhibitors such as sodium bichromate should become generally adopted for ice removal.

If sodium bichromate were added to calcium chloride in the ratio of $\frac{1}{4}$ pound of sodium bichromate to 100 pounds of calcium chloride, the cost of the added material would be about $0.35 per ton of calcium chloride, and the cost of calcium chloride so treated should not be greatly in excess of this amount. The excess cost of treated calcium chloride for melting ice on city streets should, therefore, be much less than the cost of the extra damage created by the untreated or ordinary calcium chloride. Since automobiles are owned or operated by substantially all taxpayers in these days, it would appear justifiable to expend the extra money in the purchase of calcium chloride which has been treated with an inhibitor.

This paper has dealt with sodium chromate and sodium bichromate as additions to calcium chloride to inhibit corrosion or retard the rate of corrosion caused by calcium chloride on plated parts. Corresponding conclusions would have been reached had the study been made on painted or enameled parts. Badly rusted or perforated fenders are by no means uncommon.

The conditions under which the study has been carried out have been such as to simulate corrosion which would take place on cars which have been splashed with calcium chloride solution from streets if the cars are then placed in a garage where concentration of the splashed solution and dirt may take place and where corrosion may be accelerated by higher temperatures if the garage is heated.

It should be apparent that chromates constitute only one illustration of an inhibitor. Many other inhibitors are available, some of which would be less effective and some of which might be more effective.

This Society has been progressive in promoting improvements in the quality of plated products. It would now appear that the time is ripe to initiate efforts having as their object elimination of unnecessarily severe corrosion conditions in centers of population where there are great concentrations of plated parts.

I might read the following statement by Dr. H. C. Mougey, which is significant: "The plater who can produce a plate more resistant to corrosion has less to fear from the severe conditions of exposure. The calcium chloride manufacturer who can decrease the corrosive action of his calcium chloride will have fewer complaints from the plating industry and the public, and he will be in a better position to meet competition from the manufacturers of other products of the same or different chemical composition."

Therefore, in a meeting of the Electro-Chemical Society, in 1930, Mougey predicts that if such a product could be produced, it would be a superior product. In this particular paper we show at least one way in which such a product can be produced. We show that the cost should not be much greater than two per cent of the present cost, and I would now submit that if the cost per ton were two per cent in excess of the present cost, that is, of untreated calcium chloride, if nothing else, they could make it up by putting in two per cent less calcium chloride in tons per square mile of road and no one would know the difference except that we would have greatly reduced this corrosion which I contend is unnecessary if there is a means of minimizing or preventing it.

Thank you.

"Spotting Out"

A paper presented before Toronto Branch February 22nd, 1937.

By STANLEY TOWN,
of St. Catharines, Ontario

SPOTTING out on plated sand castings has always been a problem and always will be, for all sand castings whether good or poor are more or less porous. Spotting out is also liable to take place in crevices of assembled steel sheet parts which are plated after assembly. Pressure casting eliminates this trouble.

Spotting out is an old problem, but it does no harm to refresh one's memory once in a while, cause discussion or provoke thought on the subject. Spotting out is caused as you know, by the absorption of hygroscopic compounds from the plating and cleaning solutions through which the parts to be plated pass.

It has been said that some castings spot out before being passed through any solutions. Largely, however, the trouble is caused by the plating solutions, more especially alkaline solutions.

Compounds which are going to cause trouble can easily be detected by placing these compounds in an evaporating dish. During humid days the deliquescent compounds will dissolve in the water they have absorbed from the atmosphere. Absorption of acid solutions will cause spotting out, but not to the same extent as alkaline solutions.

In this paper we will consider spotting out as caused by porous castings and crevices in assembled steel parts alone, apart from spotting out caused by blistered deposits.

Means of preventing this trouble have been many and varied. Some of them are as follows:

Heavy or multiple deposits to seal the pores in the castings.

Baking at temperature around 200 degrees Fahr.

Alternate rinsing in hot and cold water.

Neutralizing.

Use of a lacquer after finishing which will exclude moisture.

Letting parts stand after plating.

Placing parts after plating in a humid atmosphere to allow cyanide etc., to exude from pores.

Heavy and multiple deposits do not help as it has been found that the pores do not seal up and that absorption of solution was more or less in proportion to the length of time the parts were immersed in solution.

Baking is helpful provided it is used only to throw moisture out of castings, but some finishes are affected by high temperatures.

Alternate rinsing in hot and cold water is a great help. The number of alternate rinses should vary according to experience with the particular parts.

Neutralizing is helpful when used in conjunction with alternate rinsing. Care should be taken however, that the acid rinse does not affect the plated coating.

Drying the parts off after plating, without some efforts being made to remove the cyanide is sure to cause trouble. The cyanides creep out, react with the plated coating, sometimes dissolving all of the coating and always causing stains which in finishing invariably cut through.

Placing parts in a high humidity to allow cyanides to exude out will also cause trouble, through the reaction of the cyanides and plated coating.

Use of a special lacquer to exclude moisture is helpful, but should not be depended on alone.

No one method or combination can be set down to eliminate all types of spotting out, but the following suggested methods can be varied to suit the case with a reasonable degree of success.

(1) — After plating in alkaline solutions, castings and sheet steel parts which have crevices should be soaked in water for several hours at least. This soak should have enough Sodium Carbonate in it to prevent rusting.

(2) — Finishing should take place at this point but care should be taken that only the absolutely necessary finishing be done.

(3) — Immerse in neutralizing dip.

(4) — Immerse in alternate hot and cold rinse. Number of times to be varied according to experience; last immersion to be hot water in order to facilitate drying off.

(5) — Bake at the highest temperature possible without affecting the finish. Complete finish such as —

Brush brass upon which no finishing has been performed. Dry scratch brush. Greaseless compound.

Lacquer with lacquer suitable for maximum exclusion of moisture.

Oxidized copper which was oxidized at the second step — Dry scratch brush. Relieve. Lacquer with suitable lacquer.

Old oxidized brass finish — Remove stains and spots. Lacquer with suitable lacquer.

In dry finishing of brushed brass care should be taken regarding the wheels, etc., which are used, to avoid cutting through the finish.

Flat surfaces can safely be finished with canton flannel wheels and string wheels using greaseless compounds.

Other parts which do not finish this way can be completed by using pumice dampened with water to facilitate finishing.

As is to be expected these and any other methods are facilitated by, and more effective in, seasons of low humidity.

INSPECTION OF EXPOSURE TESTS OF PLATING ON NON-FERROUS MATERIALS

1 — Schedule of Inspections

(a) Key West, Florida

Notify L. M. Pierce, U. S. Naval Station, Key West, Fla.

9:30 A.M. Wednesday
June 9, August 4, November 3

(b) New York City, N. Y.

Notify C. L. Hippensteel, 463 West St., New York City.

9:30 A.M. Thursday
May 20, August 19, November 11

9:30 A.M. *Friday*
June 18 (day following A.E.S. Convention)

(c) Sandy Hook, N. J.

Notify C. L. Hippensteel, 463 West St., New York City

9:30 A.M. Friday
May 21, August 20, November 12

9:30 A.M. *Saturday*
June 19 (Following A.E.S. Convention)

(d) Pittsburgh, Pa.

Notify S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

9:30 A.M. Saturday
June 5, August 7, November 6

(e) State College, Pa.

Notify G. C. Chandlee, Chemistry Dept., State College, Pa.

9:30 A.M. Friday
June 4, August 6, November 5

(f) Washington, D. C.

Notify W. Blum, National Bureau of Standards, Washington, D.C.

9:30 A.M. on Wednesday
June 2, August 4, November 3

2 — Arrangements

All persons expecting to take part in inspections are requested to notify the persons designated, so that they can be advised of any change in schedule. It is hoped that each member of the Joint Committee will arrange to attend these inspections or to designate an alternate. Any other interested persons are welcome to attend and take part in these inspections. There is no objections to discussing the observations with other persons, but premature conclusions should not be drawn, and no published reference should be made.

3 — Basis of Inspection

Recently, specimen C of each set was cleaned with tripoli and water in order to observe the condition of the plated coating after one year's exposure. In addition, two new specimens of many of the sets were installed in positions D and E and were given a light coat of petrolatum. Specimens A and B have been exposed continuously without any treatment.

Consequently for many of the sets, it will be necessary for each inspector to record three ratings, namely, for A and B, uncleaned specimens; C, cleaned; and D and E, new specimens coated with grease. For the latter two it is planned also to observe and record the condition after they have been cleaned, for example with a dry cloth. Following this inspection another film of petrolatum will be applied.

In each case the ratings will be on the scale from 0 to 5. For the steel (S) and iron (I) specimens this rating refers only to the proportion of rust. On all the other base metals it refers to any defect, such as stains, cracks and blisters. The ratings are as follows:

Rating	*% of rust or other defects*
5	0
4	0 — 5
3	5 — 10
2	10 — 20
1	20 — 50
0	50 — 100

Examination of ratings given during the past year, indicates that *on the average* they are consistent with respect to some variable such as thickness. Occasionally, one inspector will assign uniformly higher or lower ratings than the average. It appears desirable therefore to discuss the ratings after each inspection so that each person will use about the same scale.

All the above activities will take some time. It is therefore requested that inspectors meet promptly at the times indicated, and be prepared to devote at least three hours to each inspection if necessary.

W. BLUM, *Chairman*,

Joint Committee on Exposure Tests of Plated Coatings on Non-Ferrous Metals, A.E.S. & A.S.T.M.

OFFICIAL PROGRAM

THE TWENTY-FIFTH ANNUAL CONVENTION — *THE SILVER JUBILEE OF THE A. E. S.*

NEW YORK CITY, JUNE 14th, 15th, 16th, and 17th, 1937

HEADQUARTERS, PENNSYLVANIA HOTEL

SUNDAY AFTERNOON, JUNE 13th

2:00 p.m. Registration, Mezzanine Floor, Hotel Pennsylvania.
Registration fees: Men $9, Ladies $6, which entitles registrant to book of tickets to be used for all functions and activities.
Membership in Society is not necessary for registration.

MONDAY MORNING, JUNE 14th

8:30 a.m. Registration, Mezzanine Floor, Hotel Pennsylvania.
9:00 a.m. Welcoming of Delegates, Members and Visitors.
Franklyn J. MacStoker, General Chairman.
Ralph J. Liguori, President, New York Branch.
Welcome to New York.
Opening Session.
Charles H. Proctor, Founder of A. E. S.
Presidential Address.
E. Steen Thompson.
Business Session:
Presentation of credentials.
Submission of amendments to Constitution.

MONDAY AFTERNOON, JUNE 14th

Papers start promptly on time.
1:30 p.m. Educational Session — Hotel Pennsylvania Ballroom.

George B. Hogaboom, 1st president of the A. E. S., presiding.

1. Summary of Researches on Electrodeposition at the National Bureau of Standards:
   Dr. William Blum, U. S. Bureau of Standards.
2. Progress Report on Exposure Tests and Laboratory Tests of Plating on Non-Ferrous Metals:
   P. W. C. Strausser and *Dr. W. Blum.*
3. The Use of Color Photography in the Inspection of Exposure Tests of Plating:
   C. E. Vincent Davies and *Dr. W. Blum.*
4. A Magnetic Method for Measuring the Thickness of Nickel Coatings on Non-Ferrous Metals:
   A. Brenner, U. S. Bureau of Standards.
5. Experiences in Evaluating Plated Coatings:
   W. S. Pinner and *L. B. Sperry*, Detroit Branch.

MONDAY EVENING, JUNE 14th

8:30 p.m. International Fellowship Club — Open House.
Ball Room, Hotel Pennsylvania.
This night will be devoted to a party for men and ladies sponsored by
The International Fellowship Club.
We look forward to the pleasure of entertaining you. We welcome you as our guest. A ticket is included in the Book of Tickets which must be used for admittance to this affair.

A Night of Entertainment

Dancing Refreshments

For complete details see I. F. C. Folder enclosed with program.

TUESDAY MORNING, JUNE 15th

9:15 a.m. A tour of New York City in de luxe coaches of the Gray Line Motor Tours, Inc. A delightful trip through the Metropolis to points of known interest. Coaches leave promptly on time from Hotel Pennsylvania.

TUESDAY AFTERNOON, JUNE 15th

2:00 p.m. An inspection tour of the modern S. S. Normandie, at anchor in New York Harbor. An opportunity to inspect one of the great ocean liners.

TUESDAY EVENING, JUNE 15th

Papers start promptly on time.

7:30 p.m. Educational Session:
Walter Barrows, Toronto Branch, past president of the A. E. S. presiding.

1. A Discussion on Barrel Electroplating:
   Presented by Philadelphia Branch.
2. Electroplating in Europe and the First International Electrodeposition Conference:
   Walter R. Meyer, Electrochemist, General Electric Co., Bridgeport, Conn.
3. The Effect of Free Cyanide on the Cathode Efficiency of Silver Plating Solutions:
   Messrs. Hirsch, Jackson, Snyder, and *Venelle*, of Philadelphia Branch.
4. The Prevention of Spotting Out:
   A review of conditions affecting the occurence of Crystal and stain spotting and methods for their prevention.
   Gustave Klinkenstein, vice-president and technical director, Maas & Waldstein Company.

WEDNESDAY MORNING, JUNE 16th

Papers start promptly on time.

9:00 a.m. Educational Session:
John E. Sterling, New York Branch, past president of the A. E. S., presiding.

1. Health Hazards in the Plating Room:
   Presented by Cleveland Branch.
2. The Cathode Efficiency of Electroplating Barrels and Its Effect on the Adhesion of Nickel Deposits:
   Albert Hirsch, Electroplater and Chemist, Carey McFall Company, Philadelphia, Pa.

3. A Resumé of Silver Plating:
   F. C. Mesle, electrochemist, Oneida, Ltd., Oneida, N. Y.
4. Simple Ideas that Worked:
   W. S. Barrows, foreman electroplater, Toronto Branch.
5. *Mr. Leo Roon*, Roxalin Flexible Lacquer Company.
   Title of paper not yet known.

WEDNESDAY AFTERNOON, JUNE 16th

2:00 p.m. A guided tour of Radio City and NBC Studios, starting from the NBC Studios promptly at 2:00 p.m. This tour will take approximately three hours.

WEDNESDAY EVENING, JUNE 16th

Papers start promptly on time.

7:30 p.m. Educational Session:

7:30 p.m.: Horace Smith, Newark Branch, past president of the A.E.S., presiding.

1. Gold Electroplating:
   Presented by Newark Branch.
2. The Barrel Rolling of Metal Parts:
   Presented by Waterbury Branch.
3. Something New in Silver Plating:
   Donald Wood, Reed & Barton Company, Taunton, Mass.
4. Air Conditioning of the Plating Plant:
   Edward C. DeLorme of Boston Branch.

THURSDAY MORNING, JUNE 17th

Papers start promptly on time.

9:00 a.m. Educational Session:

Oscar E. Servis, Chicago Branch, past president of A.E.S., presiding.

1. Brass Plating:
   As practiced by Members of the Bridgeport Branch.
2. 101 Questions on Cyanide Copper Plating:
   Contributed by members of Rochester Branch, to be read by *Frank J. Kohlmeier*, foreman electroplater Bausch & Lomb Optical Company, Rochester, N. Y.
3. The pH of Alkaline Plating Solutions:
   George B. Hogaboom, Hanson-Van Winkle-Munning Company.
4. The Manufacture of Rhodium Plating Solutions:
   Lionel Cinamon, Ch.E., Special Chemicals Corp., New York City, Member of New York Branch.

THURSDAY AFTERNOON, JUNE 17th

1:30 p.m. Final Business Session:
Discussion of Amendments.
Election of Officers.
Selection of Convention City.

THURSDAY EVENING, JUNE 17th

7:30 p.m. Banquet and Dance:
Hotel Pennsylvania Ball Room.
Informal
Entertainment — N. T. G. Master of Ceremonies and his Hollywood Revue.

THE PLATED WARE EXHIBIT

Attention is particularly directed to the exhibit of plated ware, submitted by Branches and individual foremen platers. This will be one of the outstanding features of the Convention, and worth anyone's interest and attention.

THREE GRAND PRIZES will be awarded the best exhibits shown.

PROGRAM FOR THE LADIES

Sunday, June 13th

2:30 p.m. Registration and Reception.

Monday, June 14th

Place — Hotel Pennsylvania
Time — 4:00 to 5:00 p.m.
Event— "GET ACQUAINTED HOUR"

Evening Accompanying the men as guests of The International Fellowship Club.

Tuesday, June 15th

Morning Accompanying the men on a tour of the Greater City to points of known interest.

Afternoon Accompanying the men on an inspection tour of the modern ocean liner Normandie.

Evening Place — Paradise Cabaret Restaurant
Time — 6:00 p.m.
Events—DINNER DANCE REVUE

Wednesday, June 16th

Morning See a Radio Broadcast.

Afternoon Accompanying the men on a tour through Radio City.

Evening (By courtesy of the International Fellowship Club)
Place — A New York Theatre.
Time — 8:30 p.m.
Event— A Current Outstanding New York Show.

Thursday, June 17th

Morning Open.

Afternoon Place — Hotel Pennsylvania.
Time — 1:00 to 5:00 p.m.
Event— A Party, with 20 Magnificent Grand Prizes, by courtesy of the International Fellowship Club.
Bridge and Card Party — Fortune Telling by the Narragansett Indian Princess Reba.
Refreshments — Prizes.

Evening Accompanying the men to the BANQUET.

NEW RECTIFIER BULLETIN

The Hanson-Van Winkle-Munning Company, Matawan, N. J., has recently published a new bulletin on Electroplating Rectifiers,— a new source of direct current. This bulletin, number ER-101, includes a cut of the Rectifier, information as to the construction, installation and operation and also contains a graph showing the power factor and efficiency curve.

NEW BUFF & COMPOSITION BULLETIN

The Hanson-Van Winkle-Munning Company, Matawan, N. J., has recently published a new Buff & Composition Bulletin, number BC-104. This bulletin contains pictures of the various types of buffs and compositions, plus a description of their uses.

NEW LACQUERS RESIST HEAT

A new line of clear and pigmented air-drying lacquers, specially designed for finishing electrical equipment and other products normally subjected to elevated temperatures, has been developed by Maas & Waldstein Company, makers of industrial finishes, Newark, New Jersey.

These new finishes, which are known as Durheat lacquers, retain their flexibility, color, and adhesion indefinitely at temperatures up to 300° F. They are finding application for direct and indirect lighting fixtures, lamp enclosures, radiant heaters, electric signs subjected to heat, electric ranges, ovens, and similar equipment.

Durheat lacquers are supplied in clear, black, white, and all colors, and can be applied by either dipping or spraying. They can be applied directly to any metal except polished chromium. When used on the latter metal, the surfaces to be finished are first covered with a baked coat of Chroprime.

ERLENMEYER TO COVER WESTERN NEW YORK FROM MAAS & WALDSTEIN

Floyd M. Erlenmeyer has been appointed Western New York representative for Maas & Waldstein Company, Newark, New Jersey, makers of industrial fihishes.

Mr. Erlenmeyer has had wide experience in industrial finishing, as he has in the past been engaged in both the manufacture of finishes and their practical application. He is, therefore, well equipped to serve Maas & Waldstein's customers in the territory that he will cover, and his many friends in the industry will welcome him in his new capacity. He will make his headquarters at 253 Alexandria Street, Rochester, N. Y.

MAAS AND WALDSTEIN TO PROVIDE FREE BUS SERVICE AT ELECTRO-PLATERS' NEW YORK CONVENTION

A feature of the Convention of the American Electro-Platers' Society, to be held in New York, June 14 to 17, will be free bus service provided by Maas and Waldstein Company, makers of industrial finishes, Newark, New Jersey. The M & W busses will run between Hotel Pennsylvania, the Convention Headquarters, and Rockefeller Center.

Delegates will appreciate this service, because one of the Convention's attractions, the Silver Jubilee Metal Finishing Exhibit, is located in the International Building, Rockefeller Center, which is located at some distance from the Hotel Pennsylvania.

The latest type of stream-lined busses will run between these two points on a half hour schedule while the Convention is in session. Tickets, gratis to delegates, will be obtainable at Convention headquarters and at the Maas and Waldstein Booth at the Metal Finishing Exhibit. At this booth, some of the latest developments in lacquers, lacquer-enamels, synthetic enamels, and other finishes for metal products will be displayed.

Business and Social News

BRANCH NEWS

Educational Activities

LOS ANGELES BRANCH

Los Angeles Branch of the American Electro-Plater's Society held its regular monthly meeting April 14, 1937, at the Rosslyn Hotel, with President E. R. Williams presiding. There were 17 members and 11 visitors present.

Minutes of the previous meeting, the financial report and the report of the banquet committee were read and accepted.

The Branch voted to favor the proposed amendment to the constitution creating a third vice-president. After some discussion the members decided not to favor the proposed amendment giving each Branch a vote at the national convention for each 10 members.

An application for membership from Ervin Fraunhoff was read and turned over to the Board of Managers to be reported on at the next meeting.

Don Bedwell was re-instated as an active member.

The matter of changing our place of meeting was discussed but was tabled until next meeting.

Mr. Oplinger of the Dupont Co. gave us a most excellent talk on new developments in plating especially along the line of bright plating with zinc, copper and nickel. After the talk we literally bombarded him with questions, but we didn't stump him. He seemed to know all the answers. Incidentally this Branch wishes to thank Mr. Oplinger for being instrumental in making our April meeting one of the best we have had in a long time. We would greatly appreciate it if the representatives of more Eastern concerns would attend our meetings when they are in Los Angeles.

The question box contained the following questions:

Q. What causes copper plating over steel to streak, and how can it be overcome?

A. It is probably due to impurities in the solution or poor cleaning.

Q. How can work be colored to imitate 24 carat gold?

A. Lacquer with gold colored lacquer.

Q. When wheels are faced with 60 or 80 grit emery set in cement what causes them to glaze quickly?

A. The fault probably lies in the cement. Cement should be so constituted that it will break down as fast as the emery does, thereby leaving emery always exposed.

Q. Would like some information on polishing carbon to a mirror finish.

No one present knew the procedure.

EARL COFFIN, *Sec.-Treas.*

MILWAUKEE BRANCH

The Milwaukee Branch of the A.E.S. held its regular monthly meeting at Lipps Hall May 13, 1937 and it was well attended. The Detroit Rex Products Co., of Detroit, Mich., manufacturers of degreasing machinery showed us several motion picture films of the making and use of these degreasing machines. Many questions were asked about the operation, cost, stability of solution, adaptability, etc., of the equipment. There are quite a number of these machines in operation in this vicinity, and, we believe, many members benefited directly from the

showing of the film. It was apparent from the discussion involved that the solution can be ruined to some extent, and then the solution must be returned to the manufacturer to be purified. Contamination with water is one of the most disastrous reactions with the solvent used in a degreasing machine. The Detroit Rex members, who showed us the film, were given a rising vote of thanks, and we also want to thank our librarian in his efforts to get us such information.

At this monthly meeting we reversed the order of business, having the educational session first and most members heartily agreed that this was most satisfactory. This being election night, we voted the following: Ray Goodsell as President; Vincent Sheehan as Vice-President; A. J. Hermansen as Sec.-Treas; Henry Bornitzke as Librarian; and Jack Geissman, Robert Goodsell, Dexter F. Rhodes as the Board of Managers. Our delegates to the New York Convention are Dan Wittig, Robert Steuernagel and Ray Goodsell, with Jos. Bykowski, Rodney Olson, and Harry Unke as alternates.

This was also the first meeting after the annual Milwaukee Smoker, and we believe we had one of the most successful sessions it has ever been our pleasure to entertain here. The papers by Wm. C. Geissman, Phil Ritzenthaler, and Max Ackerman, were very timely, and the innovation of having Geo. Hogaboom answer questions as part of the session was excellent.

A. J. HERMANSEN, *Sec.-Treas.*

TORONTO BRANCH

Without any special feature to attract them, a goodly number of our members attended the March meeting. Two applicants were elected and several items of important business were given attention.

Dr. J. F. Mackey, an Honorary member of Toronto Branch passed to the great beyond early in the month. A floral piece was sent to the home of the deceased and a letter of condolence was sent to the bereaved family. Dr. Mackey was principal instructor of our classes at the Technical School for several years.

Discussion of the amendments offered by Chicago Branch was postponed until May meeting when our delegate will be instructed as to action to be taken.

Our Annual Euchre Party which was to held March 17th, was cancelled and plans are now being made for the event about the middle of April.

Unlike the Canadian Mounties, Martin Robinson did not get his man, but we still think Martin deserves a medal.

Harry Hand, our esteemed Secretary-Treasurer, is gaining strength rapidly and will leave the hospital about March 27th if all is well.

Two serious accidents in Ontario within recent weeks have been of particular interest to platers here. One accident in which two deaths resulted is as yet unexplained, but we understand the cause was inhalation of cadmium dust during some operation in an industrial plant. In any event, if you are tempted to melt cadmium — DON'T DO IT.

The second accident resulted from placing a refrigerator evaporator coil in a hot alkaline cleaning solution. The tank was blown apart and two men were seriously scalded. These coils may contain sufficient Sulphur Dioxide to do great damage when placed in a hot solution. If you do not know how to handle them, don't try to clean and tin plate one. We mention these accidents simply to

remind you that something may happen if proper care is not taken.

All members of Toronto Branch who are in or near Toronto will probably have a chance to visit one of Canada's largest nickel refineries this Spring. Detailed notice will be sent out well in advance of date of the visit.

W. E. BARROWS

ANDERSON BRANCH

Anderson Branch held a business meeting May 17, 1937, at the Y.M.C.A. with twenty-two members present. The meeting was called to order by President James Minton.

The Treasurer's report was read and indicated a fairly healthy condition and all bills paid. Reports were heard from the committees for our annual banquet to be held May 22. The ticket committee reported 136 tickets sold with prospects of reaching 175. The place decided upon is the Grandview Golf Club House which has excellent facilities for our purpose. The program committee has arranged for the following speakers: W. M. Phillips of General Motors; Dr. Mathers of Indiana University; Judge Joseph Woeste of Cincinnati; and Carl Cleaver, founder of Anderson Branch.

Music, liquid refreshments and smokes are provided for and prospects look good for a highly successful banquet.

The election of officers for the coming fiscal year was held and after the smoke cleared away, we found the following new officers: President, George Onksen; Vice-President, L. R. Hinsch; Secretary, Roy Phillips; Treasurer, Charles Hauri; Librarian, Robert Wagner; Board of Managers: James Minton, William Castell, and Otto McCallister. Delegates to the Convention are: Robert Wagner, Guy Cole, and William Castell; alternates chosen were D. A. Cotton, Merton Beckwith, and George Onksen.

L. R. HINSCH *Sec.*

BOSTON BRANCH

On Friday, May 7th, the Boston Branch had the pleasure of listening to a most interesting talk by Mr. Higgins of the Packard Motor Co.

Although the announced subject was the Copper Plating of Die Castings, Mr. Higgins opened his discourse by a very informal discussion of the present state of the art of Bright Nickel Plating based on his own experience. He pleaded with the platers who were operating or interested in bright plating to get together and discuss experiences, troubles and triumphs in the art so as to do away with the air of mystery which surrounds it and which he considers to be the worst handicap that Bright Nickel has to overcome.

The matter of "throwing power" of bright solutions needs study and improvement both by the plater and by the manufacturer of the solutions. The cost of bright plating by means of the various solutions now on the market is being investigated by Mr. Higgins, but information of this sort could not, naturally, be disclosed. The overall cost of bright nickel over the conventional dull plate and subsequent coloring is so much in favor of the bright plate that savings of seventy-five per cent and over may and are being made from nickel tank to finished work.

After much discussion, Mr. Higgins returned to his paper and took his audience through the many vicissitudes encountered in the plating of die castings to withstand severe exposure. Many early failures led finally to adoption of the present specifications; die castings free from copper or very

nearly so, the minimum amount of polishing possible; plating with three tenths of a thousandth of copper in a bath having a low free cyanide content; and transferring to a bright nickel bath without coloring the copper and there depositing seven tenths of a thousandth of nickel. The work is then colored and chrome plated. This class of work is the only nickel that is colored in the plant.

Mr. Higgins talked as a plater to platers. His talk was direct and easily followed and his conclusions were clear cut and to the point. In answering questions and discussing the problems brought before him, he was most helpful.

Altogether, the Boston Branch will long remember Mr. Higgins with gratitude and good feeling.

A vote of thanks was given Mr. Higgins for his very interesting talk. The meeting adjourned at 11:15 p.m.

A. W. GARRETT *Sec.*

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ANACONDA
Copper Anodes

...because their unexcelled purity assures uniform corrosion, the highest quality deposit in the shortest possible time and low scrap losses. Furnished with suspension holes drilled as desired, or tapped for end hooks.

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THE AMERICAN BRASS CO.
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Offices and Agencies in Principal Cities

Boston Branch met Thursday the 7th at the Manger Hotel, Boston, at 8:00 p.m., with President Mintie in the chair.

Minutes of the previous meeting read and approved. Communications read and placed on file, bills read and moved that they be paid.

Four applications read and approved by the Board of Managers and elected to membership as follows: Harry M. Saltzberg, 46 Wolcott Ave., Dorchester, Mass.; Lester F. Pope, 27 Overlea Ave., Saugus, Mass.; Charles E. Cherry, 170 M St., South Boston, Mass. and Edward J. Saulnier, 38 Manchert St., Lawrence, Mass.

Three applications were read for the first time and turned over to the Board of Managers as follows: Henry A. Perry, 1 Walnut Terrace, Newtonville, Mass., Associate; William Lawson, 42 Elm St., Whitinsville, Mass., Active; and William Irby, General Electric Co., River Works, Lynn, Mass., Associate.

Committees will be appointed at the next meeting for our annual picnic to be held sometime in July.

The following were nominated for office to be elected at the next meeting: President, Arthur J. Mintie; Vice-President, Edward C. DeLorme; Secretary-Treasurer, Andrew W. Garrett; Librarian, Bert W. Sage; Sergeant-at-Arms, Wallace B. Rideout; Board of Managers, Charles O. Hardy, William A. Lawrence, and Colgate Gilbert.

The naming of delegates to the convention will be held at the next meeting.

After the regular order of business, the chair was turned over to Bert Sage as acting librarian. He introduced

Mr. James Higgins. The subject of his talk was "Copper Plating of Die Castings and Bright Nickel Plating".

WATERBURY BRANCH

The annual meeting of Waterbury Branch was held Friday evening, May 14th, in Engineers Hall. President Tennant Elwin presided. Favorable action was taken on the application of James R. Wetmore, and he was declared elected to active membership.

The following applications for membership were received: Maurice Henry, Oakville Pin Co., associate membership; James Guffie, United Chromium Corp., associate membership; and Dante Cantamessa, Waterbury Button Co., associate membership. Ordered to take the usual course. Communication was received from Boston Branch relative to its proposed amendment to the constitution. The amendment was thoroughly discussed; the sentiment seemed to be evenly divided, and it was finally decided to leave the matter to the judgment of the delegates. Communication was received from New York Branch relative to the proposed Branch exhibits at the Convention. Communication was received from Milwaukee Branch in connection with its efforts to obtain the National Convention for 1938. Favorable action was taken on the transfer of Mr. Philip LaPresti, to the Rochester Branch.

The question of a change in meeting quarters and the formation of a new chemistry class was discussed.

The possibility of holding a banquet in October was taken into consideration. The election of officers for the ensuing year resulted as follows: President, Tennant Elwin; Vice-President, William Cavanaugh; Secretary-Treasurer, William F. Guilfoile; Librarian, Ellsworth T. Candee; Board of Managers, William J. Gray, Septimus Marland, and Richard Crane. The following delegates were elected: Wm. F. Guilfoile, Wm. J. Gray, and Joseph McConas; alternates, Andrew Perrin, Sept. Marland, and Leroy Miller. W. F. GUILFOILE, *Sec.*

BINGHAMTON-ELMIRA BRANCH

The Binghamton-Elmira Branch of the A.E.S. held their monthly meeting at the Baron Steuben Hotel, Corning, N. Y., May 3rd.

At 2:00 p.m., preceding the meeting Dr. Wilson of Corning Glass Works, arranged an inspection tour of their factory, for the Branch members and their friends. Most of the surrounding cities were represented in this tour. Among them were Binghamton, Johnson City, Endicott, Elmira, Syracuse, Marathon, and Rochester. The E. H. Fetchener Co., of Binghamton had twenty-seven representatives alone. This tour proved very interesting and educational. These Corning boys certainly know their glass. They are justly proud of their work and it is seldom one finds such congenial and hospitable men as Dr. Wilson, Mr. R. D. Smith, Mr. J. VanHousen, and many others connected with the firm who did their utmost to make our visit interesting and enjoyable.

At 6:00 p.m. we congregated at the Baron Steuben Hotel to partake of a delicious turkey dinner. After the dinner our president, Mr. A. Fletcher, called the meeting to order and then turned the meeting over to Mr. Kolemier, President of the Rochester Branch, who honored us with his presence at the dinner and the meeting.

New officers for the next fiscal year were elected as follows: President, Larry Meyer, E. H. Fetchener Co.,

Binghamton, N. Y.; Vice-President, Wm. Sangenmeyer, Dietz Co., Syracuse, N. Y.; Secretary-Treasurer, Austin Fletcher, Brewer Fetchener Co., Binghamton, N. Y.; Librarian, George Simmons, Marathon Steel Co., Marathon, N. Y.; Board of Managers, Jack Harnett, Ansco, Johnson City, N. Y., Geo. Farrenz, Brewer Fetchener, Binghamton, N. Y., John Van Housen, Corning Glass Co., Corning, N. Y.

Next on the program, Mr. Austin Fletcher of Brewer Fetchener gave us a talk on barrel efficiency. Mr. Fletcher gave some interesting figures of results obtained from different types of solutions, temperatures, different sized loads, different sized barrels, current densities and pH values. This data represented a lot of hard work on Mr. Fletcher's part and was well explained. We only regret that we didn't have time to ask more questions on the subject but due to the late hour and the long distances some had to travel to get back home, Mr. Fletcher moved that we cut this part short and so we adjourned with a vote of thanks to Mr. Fletcher, Mr. Kolemier, Dr. Wilson, Mr. R. D. Smith, Mr. John Van Housen, Corning Glass Works and Baron Steuben Hotel for a wonderful time.

LARRY MEYER, *Sec.*

SPRINGFIELD BRANCH

The regular monthly meeting of the Springfield Branch, A.E.S., was held Monday evening, May 24, 1937, at the Indian Social Club, with President Seidel in the chair.

The minutes of the previous meeting were read and approved.

The applications of five prospective members were brought in by the Board of Managers and all of them were elected.

Letters from the Boston and Milwaukee Branches, proposing changes in the constitution were discussed. The delegates were instructed to vote on them as they see fit at the convention.

The nominating committee brought in a slate of prospective officers, and after several votes were taken, Mr. W. Barrus was elected President, Mr. Curtis, Vice-president, Mr. Delarme is to be the Secretary-Treasurer, and Mr. Phillip W. Prouty was elected Librarian.

The Board of Managers for the coming year will consist of Mr. T. L. Stephenson, Mr. Joseph Mongeau, and Mr. Francis Reese.

The Delegates to the Convention were then elected. Those elected were Mr. Sagar, Mr. W. J. R. Kennedy, and Mr. W. Seidel.

Mr. Delarme, Mr. Murray and Mr. Barrus were elected Alternates.

A motion was made and carried that the Secretary-Treasurer be paid the sum of $25.00 and dues per year.

A committee was appointed to bring in at the next meeting preliminary plans for a banquet, which is to be held by the Branch in the Fall. Mr. Costigan, Mr. Clark, and Mr. Kennedy were selected to serve on the committee.

A motion was made and carried, that the Branch will suspend meeting until the fourth Monday in September.

The meeting adjourned at 9:40 p.m.

H. R. DELARME, *Sec.*

HARTFORD BRANCH

The Hartford Branch of the A.E.S. held its regular monthly meeting on Monday evening, May 17, 1937, at the Hartford State Trade School.

The meeting was called to order at 8:30 p.m. with President Peterson in the chair. Minutes of the previous meeting were read and accepted.

Various communications were read, discussed and placed on file.

Under new business, three applicants were elected to membership, one active and two associate. Mr. H. B. Smith, associate member, was granted a transfer to the New Haven Branch.

At this meeting, new officers were elected for the year 1937-38, as were the delegates and alternates to the National Convention. Delegates were instructed as to how to vote on the proposed amendments by the Chicago and Boston Branches.

It was voted to continue to make our meeting night the third Monday of the month, and to meet alternately in Hartford and Bristol, as we have been doing the past year.

It was voted to allow the secretary to appoint a committee to work with him on the Research Fund Subscriptions.

At the close of the meeting, the officers were given a rising vote of thanks for the good work they have done in the past year.

The meeting was attended by fifteen members and adjourned at 10:30 p.m.

V. E. GRANT, *Sec.*

GRAND RAPIDS BRANCH

The regular meeting of the Grand Rapids Branch of the A. E. S. was held May 13. Our meetings have been drawing better attendance this year although the turnout at this one was not what we had hoped for.

All officers were re-elected; they are as follows: President, Homer G. Morton; Vice-President, John Carlson; Secretary-Treasurer, Chas. H. Whalley; Librarian, John Hawley; Board of Managers, A. Rickson, F. VerPlank, C. O. Werft.

After all business was taken care of, Mr. Nook of the Kalamazoo Plating Works gave us a talk and the members present entered into a discussion on chromium plating especially in regard to tanks and heating equipment. Mr. Nook described the electric heaters he has been using for sometime. He said for a very reasonable figure he had installed these heaters in all of his chrome tanks. They have the advantage, he said, of leaving the sides and bottoms of the tanks free of lead coils which are so hard to hang in the tanks and connect up without leaks. The lead coils develop leaks quite readily from blow outs; care must be exercised in cleaning the tanks or in pulling out lost racks etc. Mr. Nook's plant has large orders for Olds & Chevrolet and he has installed much special equipment.

After thanking Mr. Nook for his interesting and practical talk, the meeting was adjourned.

C. H. WHALLEY, *Sec.-Treas.*

NEWARK BRANCH

Newark Branch held its first monthly meeting, May 7, 1937 at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

President Samuel Taylor presided. The following officers were present: Samuel Taylor, President; John Kotches, Vice-President; George Wagner, Secretary; Paul Oldam, Librarian; George Klink, Sarg-at-arms; William Hodecker and Samuel Glickenhaus, Trustees.

The minutes of the previous meeting were read and approved.

Applications for Mr. Julius Silenick and Mr. John L. Devries were voted to take the regular course.

Mr. Michael Puglies was then elected to active membership.

A letter from the Boston Branch referring to changes of "Classifications of Members" to be amended at the New York Convention, was read and dis-

cussed. The majority of the Newark Members were talking against this amendment and it was decided to leave this matter in the hands of the delegates for their discretion.

A letter from the Executive Secretary, Mr. Wm. J. R. Kennedy, was read and placed on file.

A letter from New York Branch, A.E.S. referring to the Silver Jubilee of the Convention was read. Mr. Ralph J. Ligouri, President and Mr. John Rolff, Chairman of the Educational Session of N. Y. Branch, were present at this meeting and gave us most of the details of the Convention Program.

Mr. Nathaniel Hall was then introduced as the speaker of the evening by our Librarian, Mr. Paul Oldam. Mr. Hall gave a very interesting talk on stripping. Some of the formulas for stripping solutions are as follows:

"*To strip Gold from Silver.*" 20 Gallons Nitric Acid. 1 Gallon Hydrochloric Acid. Use Reverse Current — Carbon Anodes.

"*Rhodium Strip.*" 33% Phosphoric Acid with the addition of some chloride also fused cyanide.

"*Nickel from Brass and Copper*" Bright dip without water. Use about 25% Hydrochloric Acid.

"*Nickel from Steel.*" 3 parts Nitric Acid. 1 part Fumming Nitric Acid.

"*Nickel Strip.*" Concentrated Sulphuric Acid. When water is absorbed add fumming sulphuric to eliminate water. Reverse Current.

Mr. Hall was then given a vote of thanks for his talk. Meeting adjourned at 11 P. M.

The second monthly meeting of the Newark Branch, A. E. S. was held on Friday evening, May 21, 1937 at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

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8"—8¢ each 9"—9¢ each

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President Samuel Taylor presided. The following officers were present: Samuel Taylor, President; George Wagner, Secretary; Nelson Sievering, Treasurer; Paul Oldam, Librarian; George Klink, Sarg-at-arms; and William Hodecker and Samuel Glickenhaus, Trustees.

The minutes of the previous meeting were read and approved.

A communication from the Dayton Branch, asking our support for the 1938 Convention, was read and discussed. Upon motion duly made and seconded it was voted that this matter be left to the delegates to the New York Convention for their discretion.

Application from Mr. Henry Neurenberg was voted to take the regular course.

Mr. Charles R. Campana and Mr. Raymond Thomas were then elected to Active Membership.

Mr. Horace Smith and Mr. Thomas Haddow informed us that the Fellowship Club had made arrangements for an enjoyable night on June 14th, the first Convention Day, at which time Newark Branch will pay tribute to New York Branch. They asked all the members to bring their wives and friends on this occasion. The Secretary was instructed to have 1,000 cards printed in

silver and black with the special composed song for the A.E.S., which will be the theme song of the evening.

Election of officers for the year 1937-1938 then followed with the following results: George Klink, President; Wm. Hodecker, Vice-President; George Wagner, Secretary; Nelson Sievering, Treasurer; Paul Oldam, Librarian; Roy Stout, Sarg-at-arms; Samuel Taylor, Samuel Glickenhaus, Thomas Haddow, Trustees.

The following members were elected as delegates to the New York Convention: Horace Smith, George Wagner, Nelson Sievering.

The following members were elected as alternates to the New York Convention: Paul Oldam, George Klink, George Reuter.

Mr. Paul Oldam read an abstract from a paper presented by Dr. Schumpelt at the London Convention of the International Electrodeposition Conference which proved very interesting.

Meeting adjourned at 11:30 P. M.

GEORGE WAGNER, *Sec.*

DAYTON BRANCH

The regular monthly meeting of the Dayton Branch was held at the Engineers Club, Friday, May 7, 1937, with our president Mr. Abbott presiding. The minutes of the April meeting were read and approved.

Mr. Walter Fraine commented on the proposed amendment to the Constitution made by the Boston Branch and a motion was made and seconded the Dayton Branch approve this amendment.

It was decided that the Dayton Branch make a bid to bring the 1938 Convention to Dayton.

The secretary was instructed to send announcements to all Branches to this effect.

At this time officers were elected for the year 1937-1938 as follows:

President, Mr. Chas. C. Conley; Vice-president, Mr. R. J. Vandevander; Secretary-Treasurer, Mr. Corliss W. Powell; Librarian, Mr. Fred Berner; Board of Managers, Mr. Fraine, Mr. Harter, Mr. McCready; Delegates to the Convention, Mr. Fraine, Mr. Conley, Mr. VanDereau; Alternates, Mr. McCready, Mr. Hohman, Mr. Protsman.

Mr. Conley introduced the speaker for the evening, Mr. Murray, who gave an interesting talk on "Polishing and Buffing".

EMULSION DEGREASING* **IS THE LATEST!**

Beats Solvent or Vapor Degreasing, Scrubbing or Hand Wiping!

To the MEMBERS of the A. E. S., we extend our wishes for a most successful Convention, your Silver Jubilee.

The MAGNUS EMULSION DEGREASING Process combines the advantages of solvent degreasing and soap washing. Ask for details. You will benefit.

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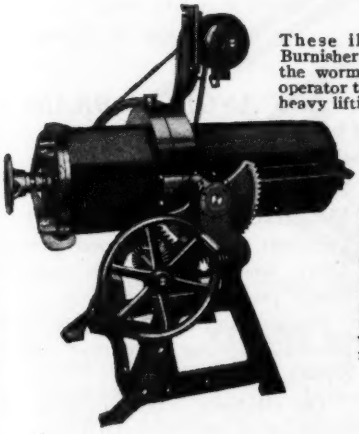

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At the close of his talk Mr. Murray answered several questions on this subject and was given a vote of thanks.

At this time a motion was made to adjourn until the first Friday in June.

CORLISS W. POWELL, *Sec.*

ROCHESTER BRANCH

The Rochester Branch held its regular monthly meeting at the Seneca Hotel on Friday night May 21. The meeting was called to order by President Kohlmeier. Minutes of the previous meeting read and approved as read. The Board of Managers then made its report which was accepted as read. The bill for the per capita tax was presented and ordered paid. The different amendments proposed to the Constitution were then read and it was decided to leave their disposal to the pleasure of the delegates. The application of Mr. Alfred W. McGuire was then read and on motion of Mr. Gartland, seconded by Mr. DelRosso he was elected to membership as an active member. Because the third Friday in June falls on the week of the convention it was decided to postpone the June meeting to June 25. Following the regular business the election of officers took place and the following were re-elected unanimously: President, Frank J. Kohlmeier; Vice-president, Charles Hehr; Secretary-Treasurer, Judson R. Elster; Librarian, Jack W. L. Snyder; Board of Managers, R. L. DelRosso, S. P. Gartland, and C. O. Fields. After the election, President Kohlmeier appointed the following: Delegates to the Convention, Mr. S. P. Gartland, Mr. H. A. Cameron and Mr. F. J. Kohlmeier;Alternates,Mr.C.H.Burnett, Mr. R. L. DelRosso and Mr. J. R. Elster. Immediately following the business session the meeting was turned over to an educational session and adjourned at a late hour.

JUDSON R. ELSTER, *Sec.*

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LOS ANGELES BRANCH

The regular monthly meeting of the Los Angeles Branch of the American Electro-Platers' Society was held Wed. May 12th at the Rosslyn Hotel. President E. R. Williams presided. There were 11 members and one visitor present.

Minutes and financial report of the previous meeting were read and accepted.

The members voted to instruct our delegates to the National Convention to vote "No" on the amendment proposed by the Boston Branch.

Bills for per capita tax and membership cards were read and ordered paid.

Mr. Ervin Fraunhoff was elected an associate member.

Mr. Thornton was appointed to contact Mr. F. A. Maurer with the idea of getting him to act as technical advisor at our meetings during the coming year.

The members voted to spend a sum not to exceed $30.00 for a projection outfit. Mr. Solivan was appointed to

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are better because they cut faster, go farther and the finish is superior.

We furnish you with a product for every job — for all kinds of steel including stainless steel and Radium.

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CEMENT and THINNER

Has been thoroughly tested in large and small plants and highly approved. It is used in place of glue for setting up wheels, belts, rolls, buffs, etc. We will be pleased to send you a suitable sample of cement and thinner for test purposes.

4A Cement and Thinner is making a name for itself the same as the other 4A Products because 4A means QUALITY and UNIFORMITY at all times.

HARRISON & COMPANY
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"A PRODUCT FOR EVERY FINISH"

look into the cost of the various pieces of apparatus necessary.

The following members were elected as officers for the year 1937-1938:

President, John L. Merigold; Vice-president, Earl Coffin; Secretary-Treasurer, Raymond Solivan; Librarian, Ray Bray; Board of Managers, E. Lamoureux, C. E. Thornton, and C. C. McLaren.

Delegates to National Convention: E. R. Williams, E. Lamoureaux, and Don. Bedwell; Alternates, E. W. Francis, Earl Coffin, and M. D. Rynkofs.

Milwaukee Branch was designated as our proxy in case none of our delegates attend.

EARL COFFIN, *Sec.-Treas.*

PHILADELPHIA BRANCH

The regular meeting of Philadelphia Branch was held on May 27, 1937. President Albert Hirsch presiding. Minutes of previous meeting were read and approved.

Communication from Dayton Branch was read and discussed.

The final report of the Banquet was received and acted upon. The committee was given a rising vote of thanks for their successful efforts, both educational and social.

It was voted that the application of Henry G. Orlik as an associate member be referred to the Board of Managers.

Dr. R. W. Wick suggested that a regional committee to act in cooperation with the Research Committee be appointed.

Messers Hirsch, Underwood, Fulforth, Dr. Wick, Gehling, Robson and R. E. Jackson, Jr. were appointed.

It was voted that the delegates be instructed to place before the Research Committee the question of ferrous and non-ferrous corrosion, the best type of solution to be used for indoor and outdoor exposure and the proper operation of same. Dr. Wick was then called upon to introduce Dr. Wernick, Hon. Sec. of the Electrodepositors Technical Society of England who is at present visiting the U. S. A.. Dr. Wernick commented briefly on the recent International Conference on Electroplating held in London. The Dr. then, by means of slides showed the advantage of the Rectifier used in England over the generator. In conclusion he expressed his pleasure at the many courtesies extended during his visit, and complimented Philadelphia Branch on their live organization and admonished the members to keep up the good work. At the conclusion of his remarks Dr. Wernick was given a vote of thanks.

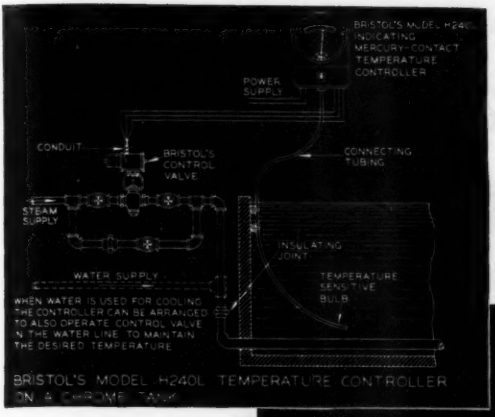
The following officers and delegates were elected: Pres. Joe E. Underwood Vice-President Fred Fulforth; Sec.-Treas. Robert E. Jackson, Jr. Librarian J. L. Nelson; Board of Managers George Gehling, Harry Snyder, Harry Keller; Delegates to the Convention, A. Hirsch, Joe. E. Underwood, R. E. Jackson, Jr.; Alternates, Harry Keller, John L. Nelson, H. C. Shelly. Moved and seconded the sec retary cast the ballot for the officers and delegates and alternates to elect. Same was carried. Then Mr. J. L. Nelson showed the members the pieces that were prepared for the microscopic test which was very interesting to all.

There were several pieces from several plants and we will have more of this in the fall meetings, Mr. J. L. Nelson has promised us.

The auditing committee is as follows, G. Long, H. Snyder and Nat. Verelle.

There being no further business the meeting adjourned.

ROBERT E. JACKSON, JR., *Sec.*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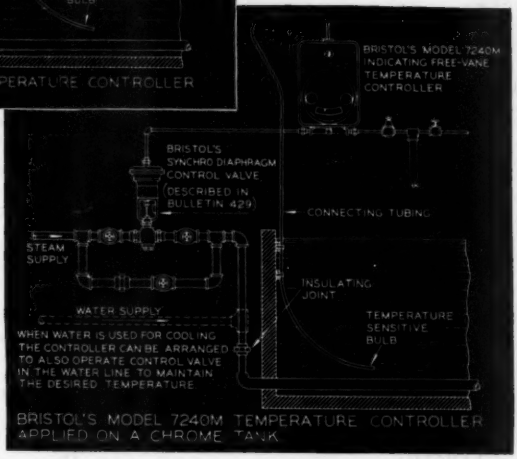
BRISTOL'S MODEL H240L TEMPERATURE CONTROLLER ON A CHROME TANK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BRISTOL'S SYNCHRO DIAPHRAGM CONTROL VALVE (DESCRIBED IN BULLETIN 429)
CONNECTING TUBING
STEAM SUPPLY
INSULATING JOINT
WATER SUPPLY
TEMPERATURE SENSITIVE BULB
WHEN WATER IS USED FOR COOLING THE CONTROLLER CAN BE ARRANGED TO ALSO OPERATE CONTROL VALVE IN THE WATER LINE TO MAINTAIN THE DESIRED TEMPERATURE
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The Abstract Section

JAMES W. HANLON, *Chairman, Program and Educational Committee*

METAL CLEANING AND FINISHING

Plating of Zinc from Ammonium-Sulphate-Zinc Baths. By DR. RAYMOND R. ROGERS—Zinc-ammonia complexes were investigated to determine usefulness in zinc depositions. Solutions containing sulphate are used primarily because of stability. Only solutions free from precipitates were considered to be suitable for electro-deposition. Eight representative solutions were investigated intensively to determine optimum conditions of temperature and current density which produce best looking deposits. Solutions in acid range were investigated at temperatures from 32° F to 195° F. Solutions in alkaline range, particularly with high ammonia concentrations, were not investigated at temperatures higher than 105° F. Results are summarized in diagrams and tables. Best deposit was secured from bath in acid range containing Zn SO_4 - $7H_2O$ - 250 gm/L, H_2SO_4 - 16.7 gm/L and $(NH_4)_2$ SO_4 - 134 gm/L at a temperature of 150° F. and 200 amps. per sq. ft.

E. T. SHEEHAN.

Cleaning Steel Chemically. RICHARD L. DAVIES. *Chem. & Met. Engin.*, Vol. **43,** 606, Nov. 1936—For heavy duty cleaning operations of steel, solutions of anhydrous sodium orthosilicate (Na_4SiO_4) are effective. Solutions of various alkaline salts at a concentration of 3% (4 oz./gal.) and at 200° F. showed that Na_4SiO_4 had a relative conductivity of 10.05 amps. compared with 3.9 for sodium carbonate, 3.25 for sodium silicate (Na_2SiO_3-$5H_2O$) and 2.52 for Na_3PO_4. The amperage was measured between two steel plates 2″ wide immersed 6″ deep and 4″ apart at a potential of 6 volts. Ph values observed were: carbonate = 11.9; phosphate = 12.3; Na_2SiO_3 = 12.8; Na_4SiO_4 = 13.5; $Na_6Si_2O_7$ = 13.3.

PHIL. J. RITZENTHALER.

Polishing Rustless Steels. A. M. PORTEVIN and R. CASTRO. *Iron & Coal Trades Review*, Vol. **133,** Oct. 2, 1936, p. 574—Inclusions in steel affect the polish quality by their number, size and distribution. Characteristics of different types of inclusions in the usual stainless steels are tabulated. The inclusions most detrimental to good polish are Al_2O_3, silico-aluminates, or aluminates and the nitrides of Titanium. Least harmful inclusions are oxysulfides and sulfides, chromous oxides. Effect consists in reducing hardness and reflecting power of polished surface and in causing brittleness.

PHIL J. RITZENTHALER.

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•

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Application of Skin Effect in Thin Metal Layers. J. GOLDFELD & N. I. KOBESER. *Acta Physics* - Chimica (U.S.S.R.), Vol **5**, 243-270, Nov. 2, 1936—A new testing method based on skin effect involvig then measurement of the high frequency resistance has been worked out for the study of thin metallic layers (electrolytically deposited) upon a base metal. Properties of an iron coating on Pt, Ag, and of Zn on iron were investigated. The variable time, thickness of deposit, current density and temperature were studied. The testing method was found to be useful for investigation of kinetics of the crystallization process. The annealing tests are interpreted on the basis of alloy formation at the interface of both metals and their upper limit of diffusion speeds is calculated.

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